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Sharing the Fish '06

Allocation issues in fisheries management

27 February–2 March 2006
Fremantle, Western Australia

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Background: Beach landing at Dar es Salaam, United Republic of Tanzania.
Inset: A fish market scene in Dar es Salaam, United Republic of Tanzania.
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Preparation of this document

The "Sharing the Fish '06: Allocation issues in fisheries management" conference was organized to address the fundamental, and essential, question of "When fisheries are under fishing pressure, who gets what?" It was also an obvious next step after the FishRights99: Use of property rights in fisheries management conference that was also held in Fremantle, Western Australia, and similarly hosted by the Department of Fisheries of the Government of Western Australia in cooperation with the Food and Agriculture Organization of the United Nations (FAO) six years prior. As previously, over 345 delegates attended.

These proceedings provide the main papers and presentations from Sharing the Fish '06 Conference, which identify and show how the fisheries sector has tried to grapple with some of the many issues that are associated with:

- allocations across jurisdictions (including governmental, regional and multilateral issues);
- allocations within sectors; and
- allocations between sectors.

This document has been prepared by a team consisting of Ms Dana Isokawa, Ms Yuanbo Liu, Dr Fred Wells and Dr Rebecca Metzner. The attached CD-ROM contains the complete version of all contributions presented during the conference.

The sponsorship received from governments, organizations and companies who permitted their staff to provide time and effort in support of the various Sharing the Fish '06 Conference Organizing and Steering Committees was, and still is, most greatly appreciated. Finally, the conference would not have been able to proceed without the financial support of its sponsors, and that support is greatly appreciated.

Abstract

These proceedings contain the main papers and presentations from "Sharing the Fish '06: Allocation issues in fisheries management" conference that was held in Fremantle, Western Australia, 27 February to 2 March 2006. They include the substantial work of the keynote and invited speakers covering the three themes of the conference which addressed the critical fisheries management topics of: (i) allocations across jurisdictions (including governmental, regional and multilateral, and national allocation issues); (ii) allocations within sectors (including extractive and non-extractive allocations issues; management issues; and, commercial, artisanal and tourism allocations issues); and (iii) allocations between sectors (including customary/indigenous, recreational, commercial, and artisanal/subsistence allocation issues). The enclosed CD-ROM contains the papers from the concurrent sessions which delved further into each of these allocation topics as shown in the Conference Programme section and mentioned in the Summary Reports and Overview section.

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Note from the editor

THE ALLOCATION ASPECTS OF FISHERIES MANAGEMENT

We all know that fishing means vastly different things to different stakeholders. If you are a subsistence fisherman, catching fish may mean the difference between having food to put in your child's stomach and going hungry. If you are a commercial fisherman, catching fish is about making money and may mean the difference between being able to pay your bills and having the bank foreclose on your boat. For recreational fishermen, it may be that the quality of the fishing experience may mean as much or more than actually bringing home fresh fish, but the recreational outing or event certainly involves having a "sporting chance" of at least having some fish to catch. And, for the folks who simply like to know that there are sustainable levels of fish somewhere "out there" to enjoy knowing about and for our grandchildren to appreciate, it is simply just knowing that fisheries are not overfished.

Once upon a time, there were fewer people and our fisheries resources plentiful enough that all people could fish and all types of different interests could all be accommodated. But that was once upon a time. Nowadays, we're in the invidious situation that we have limited resources, many more people, and we have to share what we have. This means finding ways of sharing that do not cause conflicts, either within stakeholders groups, or between them. But what can we do to share successfully?

All types of fisheries management regulations, inevitably but implicitly, allocate fish in some way, and hence it is important to also consider the allocation impacts that regulation can have. Time closures can affect participants with less powerful boats in ways different from more powerful boats, gear restrictions may affect users of one gear type more than another gear group, vessel size restrictions may affect different vessel owner groups, area closures can affect participants originating from different ports, etc.

Indeed, it is important to consider the positive and negative forces and impacts that are created by fisheries management regulations and to be aware of the effects that different management approaches will have on management costs and complexity, fishing capacity, stakeholder groups, social objects, and sustainability and resource objectives.

TACKLING THE QUESTION OF SHARING THE FISH

The idea for the conference was first raised when Peter Rogers was closing the FishRights99: Use of property rights in fisheries management – a conference that was also held in Fremantle, Western Australia, and similarly hosted by the Department of Fisheries of the Government of Western Australia in cooperation with the Food and Agriculture Organization of the United Nations (FAO) six years prior. The topic was also an obvious next step after *FishRights99*, given the emerging realization that such sorts of management systems are frequently more successful than command and control approaches to managing many types of fisheries for both economic and biological viability.

This brings us to the question of rights-based fisheries management systems. Rights-based fisheries management systems – of which there are *many* types and *infinite* variations – have to grapple with the issue of allocation on an explicit basis, both in their design phase and in their implementation phase. Indeed, one of the obstacles to establishing rights based fishery management systems involves resolving issues of initial and subsequent means of allocation instead of simply choosing to ignore them or relegating them to the "too hard" basket. Thus, it made sense to at least start to try

to address the complex and multifaceted issue of allocation in the hope that we may improve our understanding of what has worked, what has not worked, when, where, how, and why.

And so, the idea was nurtured by both the FAO and the Department of Fisheries Western Australia to create Sharing the Fish '06 Conference. Indeed, it is a tribute to the Department of Fisheries Western Australia that it hosted another globally relevant conference – attracting 346 delegates – on an issue that is at the heart of all we do in fisheries management, and FAO again enjoyed collaborating and cooperating with the Department.

Given the short duration and lengthy nature of the topic, the conference organizers designed an artificial structure that was intended to help participants focus on the fundamental question of: "How may fisheries managers and policy-makers go about considering, undertaking and implementing the allocation of fish resources to ensure their sustainability, be these issues considered at the stakeholder, local, national, international or regional level?"

Of course, the reality of the fisheries world is quite a far cry from our "optimal" visions – as the overlaps and similar messages that emerged from these different themes serve to remind us. Nonetheless, the conference was structured under three main themes with a substantive keynote and several invited speaker presentations serving as the starting point for further discussions on:

- Allocation across jurisdictions – including governmental, regional and multilateral issues at the high seas, regional and national levels;
- Allocation between/across sectors – including spatial/temporal, extractive/non-extractive issues as well as those of allocation between the indigenous, commercial and recreational sectors; and
- Allocation within sectors – including the allocation issues which come up as part of commercial and recreational management.

In addition, there was a concurrent session on some of the approaches and tools that can be used to approach the problem of allocation as well as one on the mechanics of the reallocation of resources between the commercial fishing sectors of the Torres Strait.

LOOKING BACK AND FORWARD

From the perspective of the years subsequent to the Conference, the slow pace with which allocation issues are being addressed reflects the sensitive nature of the topic and the difficulties associated with grappling with it. Yet, progress – and it is progress – is being made, and there is now more interest in this topic than that which existed at the time of Sharing the Fish '06 Conference.

This seems to be being driven by two fundamental realizations. First, there is an ever increasing awareness of just how unsuccessful – and expensive – our management efforts have been in fisheries around the world. Second, there is a growing realization that establishing fisheries rights systems – of one sort or another (and *not* just individualistic systems) – is a responsible way forward for ensuring viable and sustainable fisheries.

Thus, we need to get on designing the *best* systems for our many different types of fisheries. Whether rights-based systems are group, territorial or individualistic, their design and subsequent implementation require addressing the notions of exclusion and inclusion – of allocation – and so it behoves us to do this thoughtfully and with strong awareness of the human, economic, and biological implications of our actions. Real life is messier than theoretical models, yet models of so-called perfection can also serve as useful backbones for our real life and, hence, messier management undertakings.

SUPPORT FOR SHARING THE FISH '06 CONFERENCE

Sharing the Fish '06 Conference was possible only through the generous support of a number of sponsors who provided either direct financial support or made available

staff who were essential for the conference's success. Special thanks go to Peter Rogers, Peter Millington, Greg Paust, and Fred Wells of the Department of Fisheries of the Government of Western Australia. Special thanks, too, are due to the Western Australian Fishing Industry Council's Guy Leyland and the MG Kailis Group's George M. Kailis who have seen the need for the fishing sector to constructively engage with government and academia to start addressing the core issues of concern for the fishing sector's future.

To all, named and unnamed, my deep thanks for your intellectual support to continue the Fremantle Series and for your personal efforts to cover the gaps created by my repeated surgeries during the planning years and, as life would have it, the week prior to the conference. I drew heavily on a number of personal relationships to have people to fill in for me, and I am very greatly indebted.

Conference organizing committee

Unlike many other conferences which may have both a Steering and a Programme Committee, these were merged into a Conference Organizing Committee which was responsible for the overall direction of the conference, its organization, content and the detailed development of the conference themes, including selection of the keynote speakers. Members were:

- Peter Millington (Chair), Director of Fisheries Management Services, Department of Fisheries Western Australia
- Greg Paust (Program Chair), Deputy Director – Integrated Fisheries Management, Department of Fisheries Western Australia
- Rebecca Metzner, Fishery Officer, Policy, Economics and Institutions Service, Fisheries and Aquaculture Policy and Economics Division, FAO Fisheries and Aquaculture Department
- Mark Edwards, Manager, Fisheries Policy, Ministry of Fisheries New Zealand
- Cream Gilda S Mau, Senior Policy Officer, Domestic Fisheries Policy, Australian Government Department of Agriculture, Fisheries and Forestry
- Catherine Smith, Manager, Domestic Fisheries Policy, Australian Government Department of Agriculture, Fisheries and Forestry
- Guy Leyland, Executive Officer, Western Australian Fishing Industry Council
- Steve Dunn, Deputy Director, Pacific Islands Forum Fisheries Agency

Sponsors

Sharing the Fish '06 Conference was only possible because of the generosity and commitment of its various sponsors:

Australian Government's Fisheries Research and Development Corporation
Department of Agriculture, Fisheries and Forestry
AusAID
New Zealand Ministry of Fisheries
Queensland Government Department of Primary Industries and Fisheries
Government of South Australia Primary Industries and Resources SA
Northern Territory Government Department of Primary Industry, Fisheries and Mines
MG Kailis Group
Western Australian Fishing Industry Council Inc

PREPARATION OF THE PROCEEDINGS

The preparation of these proceedings can only be described as the result of a serious team effort. Dr Fred Wells, Western Australia, made the enormous undertaking of tackling the papers from the concurrent sessions for their primary editing. At the FAO end, without the transcriptional and editorial efforts of Ms Yuanbo Liu and Ms Dana

Isokawa, the documentation and presentation of the papers from the plenary talks and daily recaps of the concurrent sessions would have made my work of attempting to establish a more uniform style of presentation – in part dictated by my institution's publishing conventions – and the documentation of the sessions almost overwhelming.

Finally, I have to beg the indulgence of the keynote and invited speakers who carefully scrutinize my documentation of their work or presentations and assure them that I made every effort to ensure their messages have come across as intended but, in the end, any errors are mine.

CONCLUSION

From a much more personal perspective, after investing several years in the process of designing and organizing the conference, I was unable to attend for health reasons. Thus, preparing these proceedings – listening to the presentations, transcribing, editing and organizing the papers – has been much more than the process of preparing proceedings.

Indeed, I have had the opportunity – and privilege – to learn more about the personal and intellectual aspects of each and all of the participants as well as to gain a sense of what one participant aptly described as a *stimulating and thought-provoking experience*. The conference was not as representative as it could have been in a more perfect world with many sponsors and low travel costs, but it was a start and has provided a foundation, identified gaps in our thinking, and set the scene for much-needed additional work on the topic.

Markets and their use of money certainly are an understandable medium of exchange that results in decisions that may be less arbitrary than, for example, policy decisions premised on subjective or other means of measurement – but the questions remain as to (i) whether markets and money are really the "best" vehicle and , if not, (ii) what alternatives there are. It has become clear to me, too, that it is important to work towards maintaining (but not necessarily pigeon-holing or otherwise constraining) cultural values and social structures without compromising the economic benefits of fisheries resources.

In closing, I am most thankful that each and every one of the participants has provoked and inspired changes in how I – and perhaps future readers, too – will think about how to go about working on the question of sharing the fish. More than ever, it is clear that rights-based fisheries management systems need to be designed to consider social and cultural values, existing governance and institutional structures (or the lack thereof), the strength of legal systems and their ability to uphold rights, to name a few. In short, it is imperative that we genuinely mean it when we say there is not one single style of rights-based system that will work for all fisheries situations – and, having said that, we *act* accordingly.

Rebecca Metzner
Main Editor, Conference Proceedings
Fishery Officer
Policy, Economics and Institutions Service
Fisheries and Aquaculture Policy and Economics Division
FAO Fisheries and Aquaculture Department
Rome, Italy

Summary reports and overviews

1. CONFERENCE THEME REPORTS

The Organizing Committee made a conscious effort to bridge the inevitable information gap created by concurrent sessions by designing time into the program each morning for reporting to the plenary about the topics and issues raised in each previous day's afternoon concurrent sessions. Thus, the summaries which follow here have tried to capture the main issues and ideas that emerged from the thirteen thematic sections of the concurrent sessions as presented by the rapporteurs.

Thanks go for the great effort on the part of the concurrent session chairs and, in particular, the appointed rapporteurs who had to distil the substance of their sessions and prepare reports. Special thanks go to those involved in making this work as well as it did.[1] The documentation provided by the reports is also gratefully acknowledged, and great thanks are due to the whole of conference rapporteurs, Profs. Hanna and Hilborn. Their task was daunting, yet it was beautifully, thoughtfully and constructively executed.

As Prof. Hanna noted at the beginning of her end of program overview, the conference was designed to bring some sort of systematic order to what is a very large topic – the subject of allocation and all its many dimensions across jurisdictions, across sectors, and within sectors. By necessity, not all topics could be considered within the three thematic areas, but that simply creates room for future conferences to continue work on this topic and to go further in demystifying and systematically addressing and sharing information about the allocation issues arising in many, but certainly not all, types of fisheries in our world.

1.1 Theme 1: Allocations across jurisdictions

The topic of allocations across jurisdictions was divided into issues of allocation on the high seas, at regional and national levels, and also covered some of the allocation issues relation to the involvement of Australian indigenous groups in fisheries management.

1.1.1 High seas allocation issues

Although the talks in this theme covered a wide range of topics, there were several recurring themes that came from the presentations and papers in this concurrent session:

- In determining fair allocation shares, it is useful to have guiding principles of resource sharing and to be aware of the incentives that can drive or impinge on negotiation processes that are part of setting these up.
- The strengths and weaknesses of management arrangements of regional and high seas fisheries (predominately those in the southwest Pacific Ocean) are becoming clear.
- The legal and policy precedents of international allocations and the trading of fisheries quotas or shares among States do exist.
- Economic analyses are valuable for assessing the benefits and costs of policies, including the unintended consequences of management decisions in one fishery and their impacts in others. and

[1] In alphabetic order, morning rapporteurs' reports were ably provided by: Britt Maxwell, Len Rodwell, Richard Sisson, and Neil Thomson for Day 1; Transform Aqorau, Andrew Hill, Graeme McGregor, and Mark Pagano for Day 2; and Heather Brayford, Rick Fletcher, Amanda Hamilton, Antony Lewis, Jo McCrea, and Guy Wright for Day 3.

- There are challenges to regulating unregulated high seas fisheries, but it is useful to remember that is also a range of solutions availably, from outright moratoriums to market-based systems of management.

In looking forward, it was noted that it would be useful to combine the knowledge and experience from these sessions into a paper, with the objective of starting to outline what is best practice in high seas and regional fishing governance and allocation arrangements. Doing so, it was noted, would provide the platform for addressing the questions of: (i) What can we do now? (ii) Where are the gaps? and (iii) Does a market solution – or any other solution, for that matter – start to fill the gaps?

1.1.2 Regional allocation issues

Whether bilateral or multilateral, the regional allocation issues theme similarly had several recurring messages which emerged:

- The setting of limits within the membership of a regional management entity provides an opportunity for members to introduce a rights based approach to management and, subsequently, increase the benefits members can derive the fishery or fisheries in question.
- The resolution of allocation issues by members is critical to addressing conservation concerns.
- The management measures already taken do, as is mentioned elsewhere, have allocation aspects which will, in many cases, continue to flavour the design details of future rights-based systems.
- The success of sharing arrangements – as when developing any management arrangement - may be heavily influenced by the extent to which the factors of accountability, flexibility, efficiency and the use of the ecosystem-based approach to fisheries management are present and upheld. Indeed, it was considered that ownership of the process, from fishermen to participants involved at the regional level, is a key ingredient for success.
- There is a role for explicit equity-related provisions in sharing fish between developed and developing countries.

The main lesson learned was that, inevitably, there will be similar approaches to allocation adopted. There are only so many ways to share, to allocate fish – so it is critical to look at the circumstances that provide the best results for the participants involved.

1.1.3 National allocation issues

Of all the papers presented, if there was one key message, it was that *expectations* - rational and otherwise, based on historical facts, traditions or merely perceptions - play an important part in any discussion about resource allocation.

The array of interrelated presentations presented a variety of perspectives – those of the facilitating resource sharing arrangements, those involved in them, those having to manage them, those stakeholders who want to be involved, and of those designing them – and yet managed to highlight several consistent themes. Key findings of the sessions included that it is important to:

- develop a process or work within a policy framework, not only in terms of jurisdictions and legal responsibilities, but also in terms or respective roles;
- clearly establish who is involved and in what capacity (partner or stakeholder);
- determine the facts, especially regarding pre-existing rights (and whether real or perceived);
- use comprehensive (and preferably compatible) data, as it is crucial to good decision-making;
- identify, clarify and manage expectations;
- extensive and meaningful consultation is essential; and

- take ecosystem needs into account before allocating the biomass to various fishing sectors.

Again, and especially from the practitioners' perspective, it is critical to be able to identify what can and cannot be achieved when undertaking allocation actions – i.e. to genuinely clarify expectations among all involved - and to have a resource sharing agreement that includes, comprehensive data, transferable allocations, and manageable and measurable total extractions.

1.1.4 Australian indigenous allocation issues: South Australia and Northern Territory perspectives

The papers in this session focused on the ways and means of involving indigenous Australians in fisheries management. Although early decisions have been based on customary non-commercial use of fisheries resources, the principles and networks developed generating the Indigenous Land Use Agreements (ILUAs) under the Native Title Act 1993 will provide a significant degree of trust to commence discussions about the allocation of resources for indigenous commercial fishing as well as customary indigenous fishing.

Key points and findings of the presentations related to what was learned in terms of management, legal issues, and responding to aboriginal and commercial fishing interests:

- Management – The lessons learned include the need to: (i) establish broadly agreed principles on which negotiations and actions are based (e.g. the National Principles); (ii) maintain enough flexibility to let local issues drive local arrangements; and (iii) include allocation in management decisions to avoid management making allocation by proxy through management arrangements.
- Legal issues – The inclusion of indigenous customary use in new fisheries management plans was, in part, as an alternative to the uncertainty, duration and potential divisive nature of the litigation process and, indeed, the outcomes of such a process.
- Aboriginal stakeholders – The inclusion of aboriginal stakeholders in the decisions demonstrated the importance of providing a legitimate place at a table which includes all stakeholders and ensuring that spokespeople are genuinely representative and aware of the spiritual, emotional and substantive issues.
- Commercial fishing stakeholders – benefits and strategic approach to identify goodwill, potential means of limiting the diminishing of commercial fishing rights, and the training of indigenous people in fishing.
- Definition of rights, co-management opportunities, and the allocation of future commercial interests to valid stakeholders.

It was clear that relationships and communication are central to developing strong, successful and enduring outcomes that enable people to move forward in the fishing sector. In particular, the two key recommendations from the session were that:

- frameworks which build a set of mutually reinforcing systems need to be developed; and
- building trust and communication allows for negotiation and the development of appropriate arrangements which satisfy the aspirations of management, commercial, recreational and indigenous interests.

1.2 Theme 2: Allocations across sectors

Within the theme of allocations across sectors, there were four concurrent themes: Spatial/temporal allocation issues, extractive/non-extractive sector issues, allocation between commercial and recreational sectors, and commercial management issues.

1.2.1 Spatial/temporal allocation issues

The ten papers within this session regarding spatial and/or temporal allocation issues made the respective key points of:

- If an allocation framework is really necessary, it should not necessarily involve the government intervention.
- For equity reasons for the fishing industry, allocations to non-fisheries sectors should be reconsidered, if not reduced.
- Spatial allocation exclusively to the recreational fishing sector can promote harmony through increases in fish stocks.
- Data is essential, particularly in situations where localized targeting of stocks may or may not coincide with spatial allocations.
- It may useful to implement spatial and temporal programs up front, not after a fishery has been well established.
- Competition for coastal space, especially between aquaculture and capture fisheries, security of access rights is a fundamental element of successful programs.
- Representative stakeholder interest and involvement, from a variety of sectors, is vital for successful and enduring allocation systems and minimize conflicts.

In summarizing the session, it was noted that there were three possible categories of issues raised: first, who fishes where – with rights going to either the commercial or the recreational sector; second, who decides where to fish – whether through direct government intervention or other means; and third, how the decision is made regarding who gets to fish and where – whether through non-regulatory actions, co-management activities, market-based systems, or means. Perhaps the most innovative proposition of the session was for the establishment of dedicated protected productive commercial fishing areas to secure the future of the fishing industry, with the caveat that other users access the other areas should have temporal access rights.

1.2.2 Extractive/non-extractive sector issues

There were essentially two groups of papers presented: those about marine planning and processes that have affected marine resource allocation, and those about their direct and indirect impacts on allocation of marine resources. Zoning and rezoning topics – and the social challenges including compensation associated with these were flagged as important elements. Key points and findings included that:

- Marine protected area zoning may result in de facto reallocation from the commercial fisheries sector to tourism and/or conservation.
- Zoning processes can significantly alter the economic viability of (fishing) activities.
- Resolving conflicts before users and implicit allocations become entrenched is useful.
- Social impacts tend to be underestimated (particularly in the absence of full information) and, when underestimated, can create significant challenges to planning and budgets.
- Broad management frameworks are useful for marine planning to guide the myriad of considerations that should be taken into account.

Where there are processes for non-fishing planning, it was noted that is useful for MPA and fisheries managers to work together to achieve both economic and conservation issues. Broad-based marine planning processes need to fully identify the scope of all users, stakeholders, and uses.

Authors pointed out that competition between uses - such as between the establishment of MPAs and commercial fishing - need to be recognized and addressed along with the potential to create and a race for space. Political and human factors can and will strongly influence outcomes, and it is vital to encourage full stakeholder engagement and participation. Both market and planning approaches can co-exist

usefully, but it is important that these approaches be consistent across and within various sectors. Mechanisms to provide economic returns to those affected by direct or implicit reallocations from one group to others are an important, but frequently unaddressed, consideration. In particular, with establishing marine protected area networks, it was emphasized that clear rights and objectives, stakeholder values, accountability and recognition of biological, social, and economic impacts are important elements of successful programs.

1.2.3 Allocation between commercial and recreational sectors

While it was noted that there are far more users than simply commercial and recreational fishers, including indigenous, customary, conservation users, the session focused on the former. Two common themes in the two sessions included the (lack of) data especially, for the recreational fishing sector and the need for the involvement of all stakeholders in processes. Key messages of the session included:

- Recognition of both stakeholders' respective rights and responsibilities is vital, particularly as allocations among sectors are increasingly clarified.
- Discretionary allocations can be problematic, and the use of more rigorous framework can be constructive for providing certainty and the opportunity to maximize value of fisheries resources.
- While most attention to date is on initial allocation issues, it is useful to consider subsequent reallocation issues, particularly as fisheries grown and change.
- Clear allocation policy, catch and effort data, extensive stakeholder involvement, and reliable commitment to policy are essential ingredients for secure and successful systems.
- Clear priorities are extremely useful for facilitating allocation decisions, along with security, exclusivity, permanence, and transferability.
- Reallocation of sector shares may be catch-based, negotiated, valuation-based or market-based, with advantages and disadvantages in terms of legitimacy, operational and enforcement costs, and stakeholders' incentives.
- Policies collaboratively developed and operated with stakeholders can provide guidance, structure, and flexibility for achieving users' respective outcomes.
- The design of allocation programs should reflect the unique characteristics of a fishery or fisheries prior to selecting on particular approach to management.
- The lack of data, particularly for the indigenous, customary, and recreational fishing sectors needs to be addressed.

In summary, it was noted that no one size management approach fits all situations, and that the conditions and characteristics of the participants in a fishery need to be seriously considered and taken into account in the design of allocation strategies and management systems.

1.2.4 Commercial management issues

Addressing current inadequacies, especially regarding ownership and control matters, harvesting rights, and quota management systems were the focus of papers in the session. The emphasis was on the economic and social objectives that can focus the choice of individualistic or community-based systems among other things.

Key success factors mentioned included sustaining high resource rentals, while ill-defined guidelines, indeterminate timeframes, lack of funding, and a lack of financial incentives for stakeholders were noted as undermining rights-based systems. Additionally, it was noted that evolutionary changes to rights-based systems and issues such as the encroachment on such systems by allocations to sectors outside the management framework can seriously threaten the success of (commercial) sector management using rights-based systems.

1.3 Theme 3: Allocation within sectors

The allocation within sectors theme was supported by four groups of concurrent session papers: those addressing commercial allocation issues and sector allocation management; commercial allocation issues: allocation and reallocation processes; recreational allocation issues; indigenous, recreational and commercial allocation issues; and approaches to the allocation problem and regional allocation issues.

1.3.1 Commercial allocation issues: sector allocation management

Papers in this session revisited and highlighted the definition of economics, namely, that economics is the study of the allocation of scarce resources among competing uses.

Ways forward for improving the economic aspects of fisheries management and management advice include: greater stakeholder involvement in management processes to increase awareness of the commercial and economic aspects of fisheries and their management, and the use of bioeconomic – not simply biological - stock assessment. The strength of linkages between good governance including independence from both internal and external political influence, equity, transparency, economics, biology and social sustainability were put forward as strongly influencing the success of fisheries management systems.

As in some other sessions, it was highlighted that even the use of rights-based systems may not result in successful outcomes if the particular form of rights-based system is not appropriate for the resource being considered. Hence, it is useful to consider the range of rights-based systems that are available and implement accordingly.

Key points reinforced messages throughout the conference, including that:

- People management is as important as stock management.
- Common managerial characteristics include the will to succeed, the ability and a supportive governance structure to make decisions in uncertainty, the ability to take a long-term perspectives, and industry cohesion.
- Stakeholder concerns, aspirations, and perceptions need to be addressed equitably
- A one size fits all management approach does not fit all fisheries conditions.
- Management approaches need to be based on biological, economic, and social considerations.
- The absence of property rights elements in a management system will likely commit a program to failure.

1.3.2 Commercial allocation issues: allocation and reallocation processes

Several papers in this session continued to emphasise livelihood agendas and economic agendas – in addition to biological agendas – and their importance for successful management regimes. Issues of social justice, internal and external perceptions of fairness, artisanal concerns and community concerns need to be addressed. Because property rights can and do have distributional and equity issues, participants noted that both for individual fishermen and for fishing communities, the benefit flows from rights-based systems will be influenced by ownership rules. Additionally, it was noted that management of expectations and undertaking processes when stocks are in relatively good condition can facilitate these activities.

Participants recognized that the economic and local social impacts of management processes need to be rigorously considered, including community versus individual objectives, and that broader issues include who can own shares and the related topic of consolidation of shares.

1.3.3 Recreational allocation issues

The session covered a diversity of topics, including recreation sector involvement in allocation processes, fishing for food or for fun, management of recreational fishing,

the effectiveness of stakeholder involvement in allocation processes, and issues related to who actually owns the fish being allocated.

Factors of success were noted as including transparency, legitimacy, and coherence at local and national levels. it was also noted that, the allocation "battle" between commercial and recreational sectors continues without resolution. Lessons learned include the need to:

- understand the aspirations of fishers;
- quantify recreational participation;
- link the right to fish to a clear annual entitlement; and
- provide for regular and strong compliance and education.

It was also noted that perceived fairness of fairness may not necessarily reflect the level of involvement in fisheries management, but stakeholder involvement may be enhanced via the method of invitation to involvement, the details of the consultative process, the provision of information, improved methods of engagement, the need for continuous involvement and comment, and the need to review processes along the way – so as to help tailor processes to the situation.

It was also recognized that improvements in stakeholder engagement are critical and proportional representation, even if mandated formally, may make a useful contribution to the legitimacy and success of recreational fisheries management.

1.3.4 Indigenous, recreational and commercial allocation issues

The session covered a range of developments in indigenous and traditional fisheries from the rights of coastal communities, traditional fishers, definition of the rights of customary fishers and inclusion in fisheries management processes, and the post-allocation situation of indigenous rights to maintain and use fisheries assets.

Issues relating to erosion of rights - to new activities such as marine reserves or reallocations of rights to other sectors - featured prominently with emphasis on the need for robust, participatory negotiated processes for resolving challenges and conflicts and clear strategies. Participants emphasized that the incorporation of indigenous people and concerns in a policy framework could be used to help clarify the role of indigenous communities in fisheries management and allocation decisions.

Once again, participants expressed the need to design fisheries management systems that help to maintain social fabric, culture, and traditions of coastal, traditional, and artisanal communities because allocation decisions can have profound impacts on communities and thus such decisions should be carefully and seriously considered to avoid negative socio-economic consequences and marginalization of those most in need. Thus, in terms of findings and recommendations, it was expressed that there is the need:

- for solid policies and legislative frameworks to secure rights for indigenous people;
- for strong governance and institutional structures, including post allocation, and with a legislative basis when possible;
- to avoid, mitigate and compensate for the adverse impacts of the allocation of new rights on existing rights holders;
- for inclusion and recognition of indigenous peoples in consultative frameworks and structures;
- for a customary framework or strategy to be in place before allocations are made; and
- to recognise and address the social and economic impacts of allocation systems, particularly those affecting potentially marginalized groups.

1.3.5 Approaches to the allocation problem: regional allocation issues

The session highlighted the tools and mechanisms that can be used to assist managers with decisions about ongoing allocation activities, particularly for recognising and addressing the social issues associated with ongoing allocation activities.

Because the social systems around fisheries will affect how individuals and communities experience and manage change, social impact assessments can be helpful in understanding how management and allocation changes can be designed and implemented. The use of dynamic models may aid in decisions about making allocations, thereby helping to clarify non-commercial, social and recreational values – and various allocation scenarios as a result. New approaches to data gathering to support management decisions need to be considered, particularly in light of shrinking budgets, to avoid situations whereby data is so sparse as to undermine the validity of its use.

The common theme throughout the session was that there is a need to go beyond typical fisheries management considerations and to look to forecast long term costs, acquire data to support management, and to understand the motivations of affected stakeholder groups. Doing so would not only facilitate management processes, but also lead to better outcomes.

1.3.6 Reallocating resources between fishing sectors in Torres Strait commercial fisheries

The session covered the shift from input controls to ITQs in the Torres Strait commercial prawn, tropical rock lobster and finfish fisheries, beginning with a history of management arrangements and the 1985 treaty between Australia and Papua New Guinea establishing a Joint Authority; recent key decisions; the details of advisory panels and the commercial buyback scheme; and the long-term commercial views of the implementation of these decisions.

Debates over allocation issues have been heated, particularly as input controls were increasingly constrictive until 2005, the implementation of a buyout scheme, and the development of an ITQ system to be implemented in 2007 for the 50% allocated to the commercial sector.

Lessons learned included that allocation issues need to be explicitly addressed to resolve them, that the use of an external expert panel facilitated acceptance of decisions, and that a rigorous timetable to which managers adhere has helped to create goodwill and support for the process.

2. WHOLE OF CONFERENCE OVERVIEWS

Perhaps one of the most daunting tasks of rapporteuring an entire conference is to find the recurring themes that run through an enormous topic – in this case, the topic of allocation. Sharing the Fish '06 Conference was extremely fortunate and honoured to benefit from two such reports. While not formally part of the conference proceedings, per se, the presentations are summarized below to provide an overall sense of the issues, ideas, and areas for future work that emerged during the conference.

2.1 Prof. Susan Hanna

In looking at the enormous subject of allocation, Prof. Hanna noted that the general themes that emerged from the papers during the conference could be summarized into two categories:

- the context of allocation and in which allocations decisions are made; and
- the identification of some emerging general trends and issues that point to future directions for the work on the subject.

The context of allocation

In terms of allocation and the context of allocation, the themes that emerged included: the properties of ideal allocation, the influence of scarcity, the functioning of institutions, the scope of allocation, the resilience of allocations, and the controversies surrounding allocations.

She noted that allocation is really at the heart of economics because it is about allocating scarce resources among competing ends, yet it is important to remember that this is an old problem in the fisheries sector and has always been imbedded in fisheries management decisions. Indeed, now, the discussion was simply becoming more explicit.

A number of ideal properties of allocation were highlighted, including that they would be:

- targeted towards specified management objectives;
- promoting efficiency;
- equitable and, so, legitimate;
- clearly as well as fully specified;
- backed by legal authorities;
- able to establish credible commitments of either threats or promises;
- transparent;
- create consistent expectations among users and all parties to the allocation;
- enforceable; and
- flexible to changing conditions in fisheries ecosystems and markets.

In the less than ideal context of real life fisheries management, it is there that the above-mentioned properties take on very specific meaning and take on form as they enter a context of the diverse economic, social, cultural, biological and ecosystem dimensions that are part of the fisheries world.

Prof. Hanna pointed out that the relative scarcity driving allocation issues is created by demand for resources exceeding the supply – both of biological and managerial resources. Thus, in looking at the evolution of allocations over time in fisheries management, when the demand for resources exceeds supply, and transactions costs are generated as management tries to address those competing demands over limited resources and engages in more expensive information, coordination and conflict resolution. However, at some point the transactions costs become high enough so as to be unacceptable and management begins to look for new solutions, for new allocations that may be less costly or, at least, contain those transactions costs.

Prof. Hanna recognized that allocation is a core function of institutions – be they government institutions or market institutions. Moreover, institutions set up the "rules of the game", and their job is to get the incentives right, to generate benefits, to distribute those benefits, and to contain and manage the transactions costs. And, she noted, it has been and continues to be a continuous conversation as to which form of institution, government or market, works best for fisheries – and the discussion is getting richer, broader, and more complex in its scope.

At the time that market mechanisms were introduced as an allocating tool into what had been the traditional realm of government, the discussion was quite narrowly focused on efficiency and individual rights, sometimes to the exclusion in many cases of other objectives of fisheries. However, over time, the discussion has broadened both over the role of governments and of markets as allocative mechanisms in fisheries.

For governments, she noted that there is movement in governments away from the centralized government decision-making about allocations to the much more active involvement of stakeholders, including some sharing of responsibility and authority with stakeholders in some co-management arrangements sometimes with the assignment of management rights in community-based fisheries resource management. Thus, there is a much broader scope for how government is involving stakeholders in the allocation process.

Similarly, she noted the broadening of the discussion of property rights systems, beyond being exclusive to individual property rights to many different forms of tradable property rights, including cooperatives and property rights assigned to communities.

The challenges of allocation are growing as the scope of the allocation discussion broadens. Part of the reason for these growing challenges is that relative scarcity in fisheries has increased as demand exceeds supply, but the scope is also broadening because many more interests are part of the allocation discussion than traditionally. Now, allocations are being made over space, over time, over a wide variety of human interests ranging from commercial and recreational, customary, subsistence, non-governmental organizations, and tourism interests; in short, a much broader array of human interests is being represented in allocation discussions. In addition, policies are being developed that have explicit requirements for allocations to ecosystem interests and needs of components of the ecosystem. Moreover, these increasingly complex discussions require significant information for understanding and framing these more complex allocation questions.

Many of the papers, she noted, illustrated the ways allocation decisions can be undermined, and this pertains to the matter of setting up allocations can be considered resilient over a range of perturbations. However, because there are many ways that allocations are set up that leave them vulnerable and less than resilient, particularly under conditions of poor enforcement where the whole structure of an agreement can be undermined when the rules are not enforced. In addition, unconstrained growth of a sector – as is occurring as part of the commercial - recreational sector allocation context where one sector has a limit on its participation and the other sector is still in a growth mode – can undermine an allocation.

So, too, it was noted that conflicts can undermine allocations, and the weak specification of an allocation is an obvious example of this occurring. Not getting incentives rights, so that people are working against an allocation constantly, and having incompatible policies will also undermine allocations.

And, she noted, that allocations are controversial and that this was a continuous theme throughout the conference. One obvious reason for this is because they involve winners and losers, something which will by necessity generate controversy, yet there are also other equally important reasons for the controversy, one of which is the competing visions for fisheries and the inability to clarify objectives for a fishery. Whether emphasising tradition or innovation, efficiency or equity, use or non-use – it was noted that these different visions need to be resolved. Finally, she pointed out, that many allocations can become controversial because the decisions are made later (rather than sooner) and when positions are hardened, thereby limiting scope for negotiation and compromise and increasing transactions costs.

Key findings and looking forward

In recognizing some of the key findings and themes emerging from the papers and discussion, Prof. Hanna focused on the issue of weak governance and the need for fully specified property rights as being fundamental for resilience.

She noted that throughout the conference there was a recognized need to transition out of what is accepted to be weak governance systems because of the increasing social, ecological, cultural and economic costs that society is bearing as a result of continuing with weak governance systems.

The agreed need to move away from certain aspects of weak governance such as freedom to fish, the negative incentives, weak enforcement, poor accountability, and very high transactions costs and included the need to move towards a different form of governance that is much more value-added (rather than volume-based); performance based, ecosystem oriented, flexible and accountable. Moreover, it was recognized that this transition needs to happen in all fisheries – from community to national, regional and international levels – because all are facing the issue of weak governance.

She noted that history has left a legacy of problems of overinvestment, low economic performance, cumbersome management processes, and the extensive effects that have

resulted from the way we have thus far managed the race for fish – and that this history and path dependence inevitably limit the scope of action that we can take – at least in terms of expectations, if not also in terms of reality, of the sorts of actions that can be taken.

In transitioning to a different kind of governance, she noted the discussions during the conference called for a variety of ways forward, including design requirements such as:

- the crafting of better frameworks – to address the very kinds of tradeoffs that are explicit in a broader kind of allocation;
- the development of better understanding - of how to craft incentives to support sustainability, so that people are taking long term perspectives and that their behaviour is compatible with what society has defined as sustainability needs;
- the need for better understanding of how to craft better incentives for ecosystem protection that work with human nature and rational self interest and also achieve environmental goals; and
- the development of better processes for the development for mutual cooperation – such mentioned in the high seas and cross-jurisdictional discussions of the conference.

Her summary also noted that the transition also carries with it requirements for legal authorities that are in place to enable allocations across jurisdictions, across sectors, and that are able to implement effective enforcement. Finally, there are requirements for new processes - for data generation and for education. In changing the way in which fisheries and fisheries management is considered, there are significant public education needs that need to accompany such a transition.

Moving to another theme emerging from the conference – namely, the full specification of property rights as a fundamental to promoting resilient allocations - she noted both that incomplete specification of allocations across sectors and jurisdictions can undermine allocations, and that tradable rights are the most effective way to reflect different and changing values unless one decides to proceed in the data intensive mode of estimating values.

The discussions made it also clear that rights can take a variety of forms and that they did not have to be individually specified rights as long as they have certain core properties of being fully defined, divisible, transferable and secure. Indeed, the discussions noted that property rights offer the opportunity to address a wide scope of incentive problems, but that it is also clear that efficiency is not necessarily the only objective. Indeed, the discussions identified a need to design innovative and different types of property rights systems that address different combinations of efficiency and equity that may be desirable in different types of fisheries sectors – subsistence, small-scale, community, recreational, customary, transboundary, high seas – in terms of applying ideal properties to specific contexts.

The question in moving forward, she summarized, is one of how to achieve the governance properties that create strong, resilient efficient governance within these very different kinds of social contexts. In doing so and getting to stronger governance, she noted that there is a great need for pragmatism. We need to avoid getting trapped in wishful thinking that ignores the very real fact that there are transaction costs and incentives associated with all alternatives available to us, and that we need to mesh the kinds of allocation and governance designs that we derive with our understanding of incentives, costs and rational self interest – in ways that we can very practically move the system towards desired outcomes.

2.2 Prof. Ray Hilborn

In placing the conference in the bigger picture of fisheries, Prof. Hilborn noted that the conference was providing a useful and constructive opportunity for learning from successful experiences of others regarding allocation – but that the experiences being

shared at the conference were from the largely industrial fisheries which represent a small portion of the world's catch and a smaller portion of the people making a living from fishing. Hence, he noted that one relevant question was whether there are lessons for the rest of the fisheries of the world that can be garnered from these experiences in developed countries.

Key lessons

Looking at the objectives of fisheries management – achieving maximum sustainable yield, providing for jobs and communities, ecosystem preservation, and (the newer) objective of economic profitability and maximum economic yields – he noted that the fisheries world seems to be making the transition from traditional to newer forms of fisheries governance. More specifically, it has been moving away from the business as usual scenario of management characterized by top down, command and control approaches, where there is no role for rights and dedicated access programs and a primary emphasis on marine protected areas and restrictive total quotas. Indeed, it has been moving towards a newer approach to fisheries management that seems to encompass an emphasis on rights and dedicated access to stop the race for fish, growing recognition of the necessity of complete specification of rights and allocation and the use of protected areas to guard biodiversity (but not as a management tool, per se).

In examining the three pillars of fisheries management – allocation (being discussed in the conference), enforcement, and science – Prof. Hilborn pointed out that we have to realize that effective allocation contributes to effective enforcement and science. Thus, in pulling out key lessons, he noted:

- Allocation is an essential part of good fisheries management, and there were many papers at the conference which indicated how a lack of hard allocation leads to bad outcomes.
- In the absence of hard allocation (firm allocations to all sectors), catch regulations becomes an implicit form of allocation.
- Most jurisdictions under discussion in the conference are moving to some form of allocation through dedicated access.
- It is clear that the primary framework needs to be about the incentives. When the incentives are rights, stakeholders will be inspired to participate and make sustainable decisions.
- There is no single approach to allocations, and all solutions need to be local and case specific, be they based on output shares (such as ITQs, cooperatives, community allocations or state auctions), space (such as territorial fishing rights, recreational and commercial fishing reserves, marine protected areas) or even time – and all tools need to be applied when appropriate.

Prof. Hilborn noted that if incentives are the number one issue, other issues to recognize include governance, data, and the role of government. Moreover, when output controls don't work, spatial allocation may be successful - although it does not necessarily address the issue of stopping the race for fish, nor will it resolve the implicit allocation issues related to marine protected areas.

In looking forward, it was noted that one issue that was not discussed broadly during the conference was the issue of who would pay for the high transition costs of moving from traditional management to the new consensus – particularly given that, without firm rights and clear allocations, there is little incentive to rebuild or facilitate the transition. Another little discussed issue involved the allocation between different fleets on different species that may reflect ecosystem interactions between different groups of species, noting that economic analysis suggests that rebuilding one species (e.g. groundfish) may decrease the economic value of the yield of another (e.g. invertebrates). Thus, another new challenge would be the one of how to allocate within ecosystems.

In touching upon some of the main themes of the conference, it was noted that, in terms of allocation rules, there seems to be a broad pragmatic consensus that historical shares are one of the usual way to proceed, with grandfathering of participants and then making a transition to other more equitable mechanisms. In terms of international fisheries, it was noted that most are plagued by poor governance and a lack of rights and, until there is a new governance paradigm in place, the situation will not likely improve. Finally, in looking to the topic of intersectoral transfers, he noted that these may occur between the recreational and commercial sectors and from fishing companies to communities (native/indigenous or otherwise). Despite the fact that community-based fisheries were not strongly represented in the conference, Prof. Hilborn noted that these are extremely important in fisheries governance.

How to go forward?

In terms of areas for research, Prof. Hilborn called for the systematic exploration of alternative governance models and legislative alternatives; consideration of mixed spatial and output control regimes, teaming up with the lessons learned from community-based regimes; further integrating governance with biology; and, developing models of individuals' behaviour in alternative management regimes. In terms of publications, there is a critical need to share the lessons learned in other fisheries. Finally, in looking forward at topics for future conferences and workshops, he noted that there is a need to look beyond the restricted set of fisheries experiences described during the conference and to look at the topics of international governance, recreational fisheries governance, spatial allocation, options for artisanal fisheries, and events to bring managers and stakeholders together to expose all to lessons learned elsewhere.

As he closed, Prof. Hilborn reminded all that we need to remember that there are millions of people out there who depend on getting fisheries management "right" and that we had lots of work still to do in learning how to better manage sharing the fish.

CLOSE OF CONFERENCE

Mr Rogers delivered the closing thoughts for the conference on behalf of the Minister of Fisheries, The Hon. Jon Ford JP MLC.

I acknowledge the Noongar people and thank them for allowing us to meet on their land. Good afternoon.

It is my pleasure to be here at the final stages of this important conference to make some closing remarks. I commend you all for your contributions to the conference and your stamina. What's more, you don't look much worse for wear than when the Minister opened the conference on Monday morning. I will endeavour to be brief to enable our visitors to WA to discover the joys of Fremantle outside of this conference room.

Considering your interest in attending this conference, either as speakers or delegates, I don't need to convince you of the importance of allocating fisheries resources, whether at the local, national or international levels. During the presentations and panel sessions, you have listened to calls to change, calls to move away from protecting historical patterns of use except where they benefit fish and their ecosystems, even calls to limit technology which is detrimental to sustainable fishing practices. We know that the world's fisheries are facing serious challenges, with many fish stocks being overfished and fish stocks in some cases in a depleted state.

The aim of this conference has been to focus on how to ensure the sustainability of fisheries by addressing the key issue of resource allocation. That may seem a lot to ask, but the fundamental question that had to be addressed during the past four days has been, "How may fisheries managers and policy-makers go about considering, undertaking and implementing the allocation of fish resources to ensure their sustainability at local, national, international or regional levels.

I have been buoyed and, indeed so have the Australian fisheries management present, by reference to Australia as one of the countries leading the way in the development of innovative and sustainable practices to protect the fish. New Zealand, Iceland, Canada, the United States and many others in their own spheres are leading the way.

We have had a number of speakers at the conference outlining other approaches to resource allocation. These had to take into account local circumstances - legal, cultural and historical – but most have the same goal: the sharing and sustainable management of our limited fish resources. Those delegates who came to this conference seeking the perfect model or solution to resource sharing may be disheartened. However, I think from the range of experiences discussed at this conference from delegates from the world highlights that there is no "one size fits all" solution. Each country, jurisdiction and fishery has its own economic, social and environmental characteristics, and that demands a flexible approach.

The outcomes of this conference have shown that protecting fisheries and allocating fish resources are complex issues that require constant review from overarching agreements at international and regional levels through to national approaches and local area management. It has been pointed out many times that fisheries managers, particularly in government, can be constrained in their ability to reallocate catches between sectors, but this conference has shown that the wider responsibility of managing fish should remain with governments as long as they continue to employ and develop clear and comprehensive policy and administrative frameworks. Within these frameworks, there is then scope for local application of policy, be it through traditional cultural networks, as in some Pacific nations, or through the private sector as in New Zealand.

As the Executive Director of the Department of Fisheries in Western Australia, I know only too well the pressures of my counterparts in other states and the Australian Government to control fishing effort through restrictions on fishing time, place and gear. However, unless there is a clear policy framework for that application, then we could fail even to sustain the fish stocks or the communities that rely on them.

I know the West Australian Minister for Fisheries is very keen to see the commercial fishing industry, recreational fisheries, charter operators and customary fishers working together on allocation and resource sharing issues. I remain convinced that fostering relationships and dialog between these groups remain the key to resolving allocation issues. I can see, however, that as much as we are able to resolve resource sharing issues in our own countries, there is a worry that uncontrolled high seas fishing and illegal foreign fishing incursions into exclusive economic zones will push the sustainability of wild catch fisheries in many countries to the limit. It is a critical issue. I remain convinced that these problems are not insurmountable as longs as governments and the users of fisheries resources recognize their mutual goal of long term sustainability and work together to overcome them.

This conference has been and excellent opportunity for members of the fishing industry, other sectors, and fisheries managers from across the globe to share ideas on how to best share the harvest from their fish resources. I trust that it has been a wonderful experience for you all, and that when you return home you will build on the momentum gathered here at this conference. It is, after all, your collective leadership which is needed to address ongoing fisheries sustainability through resource allocation. You have a responsibility to provide that leadership.

When the Minister addressed you on Monday, he said you had a great amount of work ahead of you until the conference concluded today. There is now much more to do, with greater clarity. I will finish this address by saying that you still have a lot of work ahead of you in sharing the fish and in developing and maintaining sustainable fisheries worldwide. In terms of this conference, I will certainly be encouraging the Department of Fisheries in five years time to have another conference of this type

because I still think there is huge benefit in sharing our knowledge and our experience in terms of moving forward on fisheries management issues.

My thanks go to all the organizations and government agencies who generously sponsored the Sharing the Fish '06 Conference, to the keynote and invited speakers, to all the presenters and delegates, and to the hard work of the Conference Organizing Committee without whom this symposium would not have eventuated.

May you have a safe journey home. And, those who are staying a while from other states or overseas, enjoy West Australia's hospitality.

On behalf of the West Australian Minister for Fisheries I now officially declare the Sharing the Fish '06 Conference closed.

Conference programme

Sunday, 26 February 2006

WELCOME RECEPTION, WESTERN AUSTRALIAN MARITIME MUSEUM

Sponsored by M. G. Kailis Group, Fremantle, Western Australia

Monday, 27 February 2006

Time	Session
8.30 TO 10.30	WELCOMES AND WELCOME ADDRESSES
	CHAIR – PETER MILLINGTON, DEPARTMENT OF FISHERIES WESTERN AUSTRALIA
	• Ken Colbung – Noongar Elder, Indigenous Welcome
	• Peter Millington – Department of Fisheries Western Australia The use of fisheries adjustment schemes to achieve shifts in resource allocations in estuaries and embayments in Western Australia
	• Sen. the Hon Ian Macdonald – Minister for Fisheries, Forestry & Conservation, Australian Government
	• Dr John Glaister – New Zealand Ministry of Fisheries representing Hon. David Benson-Pope, Minister of Fisheries, New Zealand
	• Ichiro Nomura – Food and Agriculture Organization of the United Nations
	Official opening
	• Hon Jon Ford JP MLC – Minister for Fisheries for the Kimberley, Pilbara and Gascoyne
	Keynote – Prof Jon Van Dyke – Professor of Law, William S. Richardson School of Law University of Hawaii, United States Allocating fish across jurisdictions
11.00 TO 13.00	THEME 1 ALLOCATIONS ACROSS JURISDICTIONS – INVITED SPEAKERS
	CHAIR – PETER MILLINGTON, DEPARTMENT OF FISHERIES WESTERN AUSTRALIA
	Prof Gordon Munro – Professor Emeritus, Department of Economics and the Fisheries Centre University of British Columbia, Canada International allocation issues and the high seas: An economist's perspective
	Prof. Rosemary Rayfuse – Associate Professor and Director of International Law Programs, Faculty of Law University of New South Wales, Australia Regional allocation issues or Zen and the art of pie cutting
	Dr Wendy Craik – Chief Executive, Murray-Darling Basin Commission, Australia Allocation issues in fisheries management
	Panel discussion

Allocations across jurisdictions: concurrent sessions (14.00 To 15.30)

	High aeas allocation issues	Regional allocation issues	National allocation issues
Rapporteur	Neil Thompson	Len Rodwell	Richard Sisson
Chair	John Van Dyke	Rosemary Rayfuse	Peter Appleford
	Jonathon Peacey High Seas Fisheries Governance: A Framework for the Future?	**Transform Aqorau** Moving Towards a Rights Based Fisheries Management Regime for the Tuna Fisheries in the Western and Central Pacific Ocean	**Ewan Colquhoun** A Practitioner's View – Negotiation of Resource Sharing in Australia's Western Tuna And Billfish Fishery
	Quentin Hanich Exclusive Economic Zones and Pacific Developing Island States: Who Really Gets All The Fish?	**Greg Peacock** Bilateral Management of Transboundary Fish Stocks: An Informal Approach to Ecosystem Based Management	**Elizabeth Foster** Resource Sharing in Australia's Tuna and Billfish Fisheries
	Glenn Joseph The Palau Arrangement for the Management of the Western Pacific Purse Seine Fishery: Management Scheme (Vessel Day Scheme)	**Nienke Van Der Burgt** The Role of Fisheries Agreements in Promoting Equity Within Resource Allocation	**Lindsay Joll** The Inter-Sectoral Resource Sharing Process for Tuna and Tuna-Like Species in Western Australia – The WA Perspective
	Hannah Parris Getting More Out of The Western and Central Pacific Ocean Tuna Convention: Current Arrangements and Future Dilemmas	**Anna Willock** Conservation Implications of Allocation Under Regional Fisheries Management Organisations, with a Focus on the Western and Central Pacific Fisheries Commission	**Alistair McIlgorm** Sharing The Ocean With an Endangered Species: The Case: Of the Humpback Dolphin Western Taiwan
	Christopher Reid Economic Implications of an Implicit Allocation of Bigeye Harvest Rights Through and Across the Board Reduction in Effort Levels in the Western and Central Pacific Tuna Fishery	**Michael Odhiambo** Fish Do Not Know The Borders: Policy and Legal Issues in Allocation of Fisheries In Lake Victoria	**Warwick Gullett** Up the Creek and Out at Sea: The Resurfacing of the Public Right to Fish
	Panel Discussion	Panel Discussion	Panel Discussion

Allocations across jurisdictions: concurrent sessions (16.00 To 17.15)

	High seas allocation issues	Regional allocation issues	National allocation issues
Rapporteur	Neil Thompson	Len Rodwell	Britt Maxwell
Chair	Jon Van Dyke	Rosemary Rayfuse	Will Zacharin
	Kate Sanderson Sharing the Fish in the North Atlantic – A Faroese Perspective	**Richard Ogutu-Ohwayo** Management of Shared Fisheries Resources: Lessons From Lake Victoria (East Africa)	**Kelly Crosthwaite** Native Title Claims Out of the Courts: Establishing a Framework for Allocating and Managing Indigenous Cultural Fishing Access in South Australia
	Frank Alcock Slicing Pies: A Political Science Perspective on Distributive Issues in the Law of the Sea Treaty and the UN Fish Stocks Agreement	**Darren Dennis** Research to Support Allocation of Indigenous and Commercial Catch in the Torres Strait Tropical Rock Lobster *Panulirus ornatus* Fishery	**Virginia Leek** South Australia's ILUA Process – An Approach to Allocation

ALLOCATIONS ACROSS JURISDICTIONS: CONCURRENT SESSIONS (16.00 TO 17.15)

	HIGH SEAS ALLOCATION ISSUES	REGIONAL ALLOCATION ISSUES	NATIONAL ALLOCATION ISSUES
	Andrew Serdy Trading of Fisheries Commission Quota Among States – Does International Law Allow It?	**Yimin Ye** Transboundary Distribution and Sharing of the Torres Strait Rock Lobster Fishery Between Australia and Papua New Guinea	**Parry Agius** Sharing the Process: Statewide Indigenous Land Use Agreement Negotiations in South Australia
	Lyn Goldsworthy Goverance Arrangements to Save the Resources of our Deep Seas for Current and Future Generations	Panel Discussion	**Neil McDonald** South Australia's ILUA Process – An Approach to Allocation
	Panel Discussion		**John Christophersen** The Future of Fish Allocation in the Waters of the Northern Territory – An Aboriginal Perspective
			Panel Discussion

Thursday, 28 February 2006

Time	Session
8.30 to 10.00	RECAP OF ALLOCATIONS ACROSS JURISDICTIONS THEME 2 KEYNOTE: ALLOCATION ACROSS SECTORS
	CHAIR – ICHIRO NOMURA, FAO
	• Neil Thomson – High seas allocation issues
	• Len Rodwell – Regional allocation issues
	• Richard Sisson – National Allocation Issues
	• Britt Maxwell – Australian Indigenous Allocation Issues-SA and NT Perspective
	• Ichiro Nomura Food and Agriculture Organization of the United Nations
	Official opening
	• Hon Jon Ford JP MLC – Minister for Fisheries for the Kimberley, Pilbara and Gascoyne
	Keynote – Prof Peter Pearse – Professor Emeritus, Economics and Forestry University of British Columbia, Canada Allocations of catches among fishing sectors: Directions for Policy Development
10.30 to 12.30	THEME 2 ALLOCATIONS ACROSS SECTORS – INVITED SPEAKERS
	CHAIR – ICHIRO NOMURA, FAO
	Mr Alistair Graham – Director of Nature Conservation Programs, Tasmania Conservation Trust, Australia Extractive and Non-Extractive Allocation Issues – An Environmental Perspective
	Dr Peter Rogers – Executive Director, Department of Fisheries Western Australia, Australia Resource Sharing – Key to Sustainability
	Dr Mahfuzuddin Ahmed – Principal Social Scientist and Director for Policy, Economics and Social Science, World Fish Center, Malaysia Allocation Issues in Marine Environment – Managing Conflicts Between Commercial, Artisanal and Tourism in Tropical Fisheries
	Panel discussion

Allocations across sectors: concurrent Sessions (13.30 to 15.00)

	Spatial/temporal allocation issues	Extractive/ non-extractive sector issues	Allocation between commercial and recreational
Rapporteur	Transform Aqorau	Andrew Hill	Mark Pagano
Chair	Steve Dunn	Andrew Read	Bill Flaherty
	Alistair McIlgorm Lessons From Inter-Sectoral Fishing Access Re-Allocation in New South Wales	**Carli Bertrand** Management of Shared Fisheries Resources: Improving the MPA Tool for Sustainable Allocation Marine Resources in U.S. Fisheries Management	**Frank Prokop** Can Integrated Fisheries Management Work Without Recreational Fishing Property Rights?
	Tracey MacDonald Protected Commercial Fishing Areas (PCFAs) – A Strategy for Ensuring Equity in Resource Allocation between Aquatic Resource Users	**Zena Dinesen** Fishing and Marine Protected Areas – How Can We Best Share the Fish to Meet Fisheries and Conservation Objectives?	**Steve Halley** Models for Allocation of Fisheries Resources Between Sectors
	Bryan Van Der Walt Recreational Fishing Havens: Promoting Harmony between Recreational and Commercial Fishers?	**Noel Taylor-Moore** Great Barrier Grief: A Case Study of the Socio-Economic Impacts of the Representative Areas Program for the Great Barrier Reef Marine Park on the Queensland Seafood Industry	**Nici Biggs** Implications of Reallocation: Case Examples from New Zealand
	Steven Shanks Allocation to Manage Spatial Fishing Effort across the South Australian Pilchard Fishery	**Vicki Mavrakis** 1 + 1 = 3 Beyond Aquatic Reserves	**William Zacharin** Maintaining Allocation Shares in Addressing Stock Sustainability: A Case Study in a Multispecies Fishery in South Australia
	Howel Williams A Clean Slate? Sharing the Return of the Tasmanian Scallop Fishery	**Rick Fletcher** Sharing the Fish, and Other Resource Access Issues: How Could This be Done at a Regional Level?	**Ronald Mitchell** A Comparison of the Management of Red Sea Bream (*Pagrus major*) in Sagami Bay (Japan) and the Related Pink Snapper (*Pagrus Auratus*) in Shark Bay (Western Australia)
	Panel Discussion	Panel Discussion	Panel Discussion

Allocations across sectors: concurrent sessions (15.30 to 17.00)

	Spatial/temporal allocation issues	Extractive/ non-extractive sector Issues	Allocation between commercial and recreational	Commercial management issues (Theme 3)
Rapporteur	Transform Aqorau	Andrew Hill	Mark Pagano	Graeme McGregor
Chair	Steve Dunn	Andrew Read	Bill Flaherty	Peter Millington
	Dorthea Huber Areas of Limited Gear Restrictions in the East Coast Trawl Fishery – A Case of Sensible Resource Sharing or the Reallocation of Fishing Rights?	**Heather Brayford** Spatial Allocation of Coastal Waters for Aquaculture Development – The Western Australian Experience	**Stephanie Madsen** Designing Dedicated Access Privilege Programs: Alternative Approaches to Balancing Benefits Among Harvesters, Processors, and Communities in North Pacific Fisheries	**Tony Craig** Growing Pains in the Quota Management System

ALLOCATIONS ACROSS SECTORS: CONCURRENT SESSIONS (15.30 TO 17.00)

	SPATIAL/TEMPORAL ALLOCATION ISSUES	EXTRACTIVE/ NON-EXTRACTIVE SECTOR ISSUES	ALLOCATION BETWEEN COMMERCIAL AND RECREATIONAL	COMMERCIAL MANAGEMENT ISSUES (THEME 3)
	Leigh Mitchell Multi-Sector Fisheries in New Zealand – Case Studies in Sector Engagement	Panel Discussion	**Greg Paust** The Implementation of Integrated Fisheries Management in Western Australia	**Daryl Sykes** The World is Full of Good Intentions: Achieving the Full Potential of Property Rights-Based Management, or Not
	Panel Discussion		Panel Discussion	Panel Discussion

Wednesday, 1 March 2006

Time	Session
8.30 to 10.00	RECAP OF ALLOCATIONS ACROSS SECTORS THEME 3 KEYNOTE: ALLOCATION WITHIN SECTORS
	CHAIR – JOHN GLAISTER, NEW ZEALAND MINISTRY OF FISHERIES
	• Transform Aqorau - Spatial / Temporal Allocation Issues
	• Andrew Hill - Extractive / Non-extractive Sector Issues
	• Mark Pagano - Allocation between Commercial and Recreational Sectors
	• Graeme McGregor - Commercial Management Issues
	Keynote - Prof Gary Libecap- Anheuser Busch Professor and Professor of Economics and Law, University of Arizona, United States Allocation Within Sectors: Assigning Property Rights in the Common Pool. Implications of the Prevalence of First Possession Rules
10.30 to 13.00	THEME 3 ALLOCATIONS WITHIN SECTORS – INVITED SPEAKERS
	CHAIR – JOHN GLAISTER, NEW ZEALAND MINISTRY OF FISHERIES
	Ms Alison Thom – Deputy Secretary Relationship and Information, Wāhanga, Te Puni Kókiri, New Zealand Customary/Indigenous Allocation Issues
	Dr Pablo Vigliano – Senior Scientist and Adjunct Professor Department of Biology, National University of Comahue, Argentina Allocation Policies and its Implications for Recreational Fisheries Management in Inland Waters of Argentina
	Prof Ragnar Arnason – Professor Fisheries Economics and Chairman Institute of Economic Studies University of Iceland, Iceland Commercial Allocation Issues
	Ms Chandrika Sharma – Executive Secretary, International Collective in Support of Fish Workers (ICSF), India Allocation of Fisheries Resources: A Small-Scale Fisheries Perspective
	Panel discussion

Allocations within sectors: concurrent sessions (13.30 to 15.30)

	Commercial allocation issues – sector allocation management	Recreational issues	Indigenous, recreational and commercial allocation issues
Rapporteur	Amanda Hamilton	Antony Lewis	Rick Fletcher
Chair	David Carter	Frank Prokop	Feleti Teo
	Vilhjalmur Egilsson Icelandic Fisheries Legislation	**Philip Kirk** New Zealand's Recreational Fishing Sector – Structure, Governance, and Participation in the Allocation Process	**Terry Lynch** Governance Arrangements for the Management and Use of Indigenous Communities Common Property
	Soile Kulmala Sharing the Baltic Salmon	**Keith Ingram** The Right to Fish for Food or Fun	**Tania McPherson** The 'Race For Space': Maintaining the Value of Fisheries Rights Allocated to Maori as Part of Treaty Settlements in New Zealand
	Gordon Gislason Allocation Within Commercial Fisheries in Canada: Pacific Herring, Salmon, and Groundfish	**Andrew Cribb** Managing Recreational Fishing Take Within a Sustainable Harvest and Allocation	**Guy Wright** National Principles for Defining Customary Fishing can Assist in the Recognition of the Customary Sector in Australia
	Kristy Saville The Evolution of Commercial Fishery Allocation Processes in Western Australia	**Rae Burrows** Stakeholder Involvement in the Allocation	**Ben Fraser** Allocating Fish Resources to Indigenous Western Australians
	Jeremy Prince Sustainability Requires Change to Allocated Property Rights: The Story of Abalone	**Bernard Walrut** Sharing the Fish – Whose Fish?	Panel Discussion
	Panel Discussion	Panel Discussion	

Allocations within sectors: concurrent sessions (16.00 to 17.30)

	Commercial allocation issues – sector allocation management	Approaches to the allocation problem	Re-allocating resources between fishing sectors in Torres Strait commercial fisheries
Rapporteur	Heather Brayford	Jo McCrea	Guy Wright
Chair	David Carter	Mark Edwards	John Catlin
	Moenieba Isaacs Has the Reallocation of Fishing Rights Contributed to Wealth Redistribution and Poverty Alleviation in South Africa?	**Paul McLeod** Socially Optimal Allocation of Fish Resources Among Competing Uses, a Dynamic Allocation Model Applied to Western Australia's Abalone and Wetline Fisheries	**Barre Kare** Management Arrangements on Shared Fisheries Stocks in the Torres Strait Protected Zone Between Australia and Papua New Guinea
	Derek Johnson Social Justice and Fisheries Governance: The View From India	**Dan Gaughan** Meeting the Data Requirements for Integrated Fisheries Management: Progress Towards Minimising the Costs of Monitoring	**Dave Johnson** History of Management Arrangements and Stakeholders Involved in Torres Strait Fisheries
	Frank Alcock Property Rights and Equity in Fisheries Management: The Significance of Vertical Integration	**Robin Connor** Necessary but not Sufficient: Allocation of Allowable Catch as a Management Tool in Shared Fisheries	**John Kung** Recent Decisions: The Protected Zone Joint Authority

Allocations within sectors: concurrent sessions (16.00 to 17.30)

	Commercial allocation issues – sector allocation management	Approaches to the allocation problem	Re-allocating resources between fishing sectors in Torres Strait commercial fisheries
	Jodie Little Quantifying Tradeoffs Between Ecology, Economy and Climate in the Northern California Current Ecosystem	**Julia Pickworth** Changes in Australian Fisheries: What can Social Impact Assessment Tell us?	**Britt Maxwell** The Role of Allocation Advisory Panels and Tenders in Implementing PZJA Resource Reallocation Decisions
	Hilary Revill The Journey Towards an Explicit Resource Sharing Arrangement for the Tasmanian Rock Lobster Fishery	**Peter Millington** A Case Study on the use of Fisheries Adjustment Schemes to Achieve Shifts in Resource Allocations in Estuaries and Embayments in Western Australia	**James Fogarty** Commercial Sectoral Views on Long Term Implementation of PZJA Resource Reallocation Decisions
	Panel Discussion	Panel Discussion	Panel Discussion

Thursday, 2 March 2006

Time	Session
9.00 to 10.30	Recap of allocations across sectors keynote panel discussion
	Chair – Peter Rogers, Department of Fisheries Western Australia
	• Amanda Hamilton – Commercial Allocation Issues: Sector Allocation Management • Rick Fletcher - Commercial Allocation Issues: Allocation and Reallocation Processes
	• Antony Lewis - Recreational Allocation Issues
	• Heather Brayford –Indigenous, Recreational and Commercial Allocation Issues
	• Jo McCrea - Approaches to the Allocation Problem
	• Guy Wright – Re-allocating Resources between Fishing Sectors in Torres Strait Commercial Fisheries
	Keynote Panel Discussion: Prof. Gary Libecap, Prof. Peter Pearse, Prof. Jon Van Dyke
11.00 to 12.30	Whole of conference overview
	• **Prof. Susan Hanna –** Professor of Marine Economics, Oregon State University, United States
	• **Prof Ray Hilborn** - Richard C. and Lois M. Worthington Professor of Fisheries Management in the School of Aquatic and Fishery Sciences, University of Washington United States
12.30	Closing address
	Hon Jon Ford J.P. MLC – Minister for Local Government and Regional Development; Fisheries; the Kimberley, Pilbara and Gascoyne

Australian focus session (14.00 – 15.00)
Issues and solutions for resource sharing in Australia
Sponsored by the Australian Government Fisheries Research and Development Corporation
Nick Rayns, Chair

Nick Rayns – Executive Manager, Australian Fisheries Management Authority, Australia	Introduction
Russell James – Department of Agriculture, Fisheries & Forestry, Australia	Coolangatta to now – where did it go?
Geoff Diver – Diversity, Australia	Well, It Looked Good on Paper – The Transition From Theory to Practice for Resource Sharing in the Western Tuna and Billfish Fishery
Ian Stagles – Western Angler Magazine Australia	Resource Sharing – Why We Are Getting It So Wrong?
Guy Leyland – Executive Officer, Western Australian Fishing Industry Council, Australia Frank Prokop – Executive Director, Recfishwest, Australia	An Overview of Resource Allocation Issues in Western Australia
Doug Bathgate – West Australian Recreational Fishing Advisory Council, Australia	Shark Bay (Inner Gulf) Stock Sustainability: a Negotiation Experience
James Fogarty – Manager Queensland Operations, MG Kailis Group Australia	Resource Allocation Issues for the Commercial and Recreational Sectors Arising from the Recent GBRMPA Planning Decisions
Alistair McIlgorm – Director, National Marine Science Centre, Australia	An Overview of Resource Allocation Issues in NSW Estuaries
Peter Appleford – Director, Fisheries, Department of Primary Industries Victoria, Australia	An Overview of the Victorian Resource Allocation Policy, and Social and Economic Valuation Issues in Bay and Inlet Fisheries
General Discussion	
John Wilson – Fisheries Research and Development Corporation, Australia	Summary & Overview
Nick Rayns – Executive Manager, Australian Fisheries Management Authority, Australia	Closing Remarks

Conference Dinner
Sponsored by the Western Australian Fishing Industry Council

Welcome addresses

The use of fisheries adjustment schemes to achieve shifts in resource allocations in estuaries and embayments in Western Australia

Peter Millington
Conference Chair
Director of Fisheries Management Services
Department of Fisheries Western Australia
Perth, Western Australia, Australia

ABSTRACT

Since 1988, a series of voluntary fisheries adjustment schemes have focused on estuarine and embayment fisheries, in areas of population growth and coastal development in Western Australia where recreational and commercial fishers compete for the limited fish resources available. The underlying assumption is that reductions in commercial catch increase the available recreational catch. The open-ended nature of recreational fisheries can mean any benefits are absorbed by this sector, but with little apparent benefit to the individual fisher. However, the opportunity cost of not having permanent effort reduction programs needs to be considered. Significant reductions in the number of commercial licences and catches have occurred in Western Australian fisheries where schemes have been introduced, increasing the potential catches for the recreational sector. Quantifying the extent of resource shifts is difficult because of the lack of empirical recreational catch data. Perception issues can dominate the resource sharing debate. Should priority be given to measuring resource shifts, or should the scarce resources available be dedicated to achieving further effort reductions? A new initiative, integrated fisheries management, will allocate explicit catch shares in certain fisheries over the next decade. However, the benefits of targeted schemes as an adjunct to achieve implicit resource reallocation over time cannot be understated.

1. INTRODUCTION

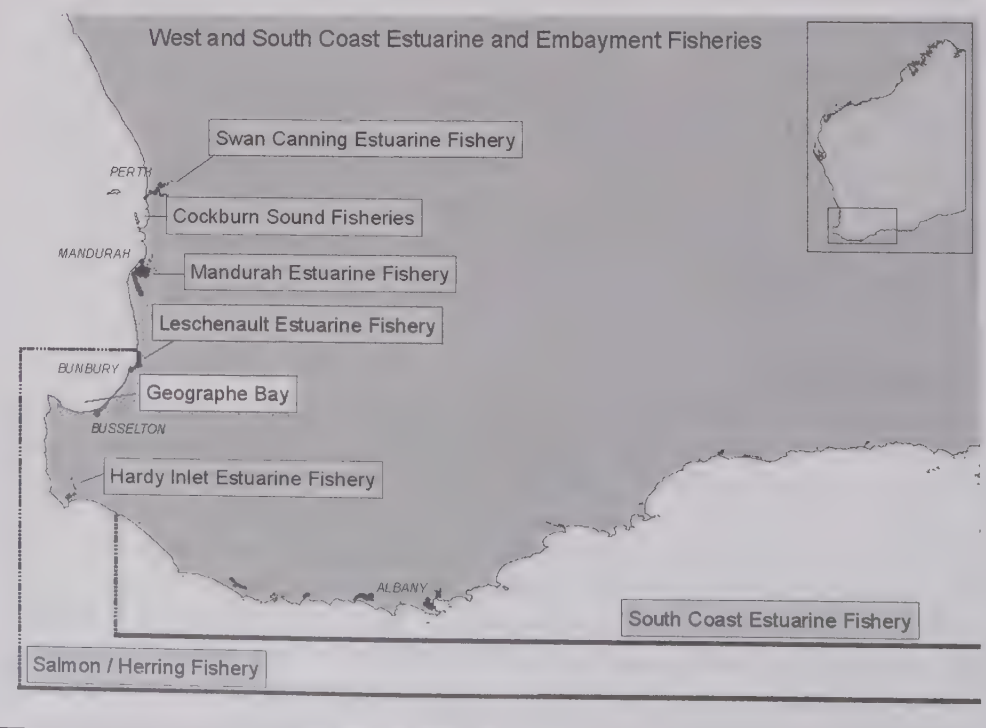
The temperate waters of Western Australia support only small stocks of fish by world standards. In the absence of major river systems enriching the continental shelf, no major upwellings and with the warm Leeuwin Current running south from nutrient poor tropical waters, nutrients to support major fish stocks are absent. The river systems that do exist are low volume, intermittent and form only small (and often barred) estuaries. The nature of the coastline provides limited protection from the prevailing fetch of the Indian Ocean, except where sheltered by an extensive offshore limestone reef system, and there are only a limited number of embayments and natural harbours. This feature of Western Australia's marine ecology was recognized early in the management of its fish stocks with the then Superintendent of Fisheries saying in 1953:

"...I do not for a moment suggest that Western Australia's fishery resources are unlimited. In contradistinction to other parts of the world, nature was somewhat niggardly when she endowed our fisheries. We certainly have many species of fish, but we have a smallish number of individuals of each species and these could possibly, without proper management, in the long run become depleted. It is essential therefore that we take very good care of what we have." (Fraser, 1953, p 19)

This recognition resulted in the early introduction of very conservative commercial fisheries management regimes in Western Australia (Brayford and Lyon, 1995). This included the adoption of limited entry as a major underpinning of commercial fisheries management (from the 1960s), especially in the major western rock lobster (*Panulirus cygnus*) fishery and the bigger prawn (shrimp) fisheries. Restricted entry regimes with limited transferability were also introduced into the major estuarine and embayment (finfish and crab) fisheries at the same time (Millington, 1998).

The major commercial estuarine and embayment fisheries in Western Australia are located in the southern half of the state, from Perth to the south coast. These include the Cockburn Sound fisheries, and the Swan Canning, Mandurah, Leschenault, Hardy and South Coast Estuarine fisheries (Figure 1). These are primarily net fisheries that target a range of estuarine species such as bream (*Acanthropagrus butcheri*), pink snapper (*Pagrus auratus*), mullet (*Mugilidae*) and crabs (*Portunus pelag*icus). In addition, there are several beach seine fisheries in the embayments targeting Australian salmon (*Arripis truttaceus*), Australian herring (*A. georgianus*), and whitebait (*Hyperlophus vittatus*). Recreational fishing occurs in a relatively unfettered manner on almost all these species in the same waters as the commercial fisheries. These are mostly undertaken through angling from shore or small boats, with a limited amount of (attended) recreational gill netting

FIGURE 1
Southwestern and southern estuarine and embayment fisheries of Western Australia



2. CAUSES OF CONFLICT

2.1 The limited resource and environmental pressures

Extensive shallow sea-grasses in embayments in Western Australia supplement the estuaries in providing nursery grounds for a wide range of species, including those of interest to commercial and recreational fishers. Many adults are seasonally available as they move inshore to breed and can give a false impression of abundance but the abundance of these species is limited. Furthermore, although the embayments are currently in good ecological condition, both estuaries and embayments are under stress from development pressures, eutrophication and reduced flushing caused by withdrawals of freshwater upstream. In addition, recruitment of many species is affected by the Leeuwin Current, which in turn is driven by El Niño-La Niña oceanographic effects.

2.2 The demographic pressures

Commercial fishers in the estuaries and embayments of Western Australia are often 3rd or 4th generation fishers. Historically they lived in small coastal towns and communities, with relatively poor transport. Conflict with recreational fishers has been intermittent over the last century, and was reported as early as the 1904 Annual Report of Chief Inspector of Fisheries (Gale, 1905; p. 4). However these conflicts were, until the late 1970s, at relatively low levels, surfacing primarily at peak holiday times and often solved by small, local, spatial and temporal closures for commercial fishers.

Over 80% of the Western Australia's population lives within 30km of the coast (WAPC 2003), predominantly in the southwest. Population growth in the southwest over the last three decades has been significant, including the development of many recreational boat ramps and marinas. Recreational boat ownership is large, with 68,493 power boats registered in a population of 1.925 million (in 2001), the vast majority of who live in the Perth metropolitan region, the southwest and the south. Ownership of recreational boats is very high (average 3.6%), and even higher in the non-metropolitan regions (up to 4.5% in the southwest). Recent population growth has been matched by an increasing participation rate in recreational fishing. Recreational fishers have been between 30 and 35% of the population over the last seven years (Department of Fisheries 2005a; p 125). The median number of fishing days is about 10, with the majority fishing about 5 days. The southwest and south of the state are key areas for recreational fishers. There is significant overlap between areas favoured by recreational fishers and the commercial estuarine and embayment fisheries.

2.3 Resource exploitation pressures

A variety of measures have constrained commercial fishing effort, including limited entry, a personalized licensing system, and, historically, a restriction of transfer of such licences to family members. These macro measures have been reinforced by gear limitation (size of boats, net mesh size and length), temporal restrictions (seasonal, weekend and day fishing closures) and area closures. These measures have had a range of drivers, including effort limitation, breeding stock protection and, in some cases, spatial and temporal separation from the mostly seasonal and/or weekend recreational fishing community. While recreational licensing regimes for certain high value species have been in place for decades, no general marine or estuarine angling licence is required. There is no political will to introduce such a licence (e.g. Labor Party 2004). While there have been progressive limitations to gill and haul netting, and there are stringent and comprehensive possession, bag and size limits in place, there is effectively no cap on recreational fishing effort. The commercial fishing sector has a wider range of available species than the recreational anglers, due to the types of permitted fishing gear (gillnets etc.). There are inevitably overlaps between sectors on key species, predominantly pink snapper, black bream, Australian salmon and herring.

2.4 The perception issues

The resource sharing debate is dominated by the perception that commercial fishing reduces the availability of fish for the recreational sector, but there is often little evidence to support these perceptions. For example, there has been a tendency for the recreational sector to blame commercial fishing for a lack of Australian salmon caught by recreational fishers. However, as indicated above, recruitment and availability of salmon are predominately driven by environmental factors, such as water temperature and strength of the Leeuwin Current. Stock sustainability is not a concern but conflicts continue to occur through the perceived lack of fish. Perception issues among the recreational fishing community about commercial fishing in estuaries and estuaries and embayments fall into three categories:

Firstly, 'fishing is not like it was'. This is an implicit recognition that as fishing pressure has increased the average size of fish caught has decreased. This is expected as unexploited populations are increasingly targeted, although the abundance of smaller individuals may rise.

Secondly, this depletion phenomenon is in most instances attributed to commercial fishers, rather than the rising number of recreational fishers.

Thirdly, there is competition for space. Most estuaries are small and commercial fishing activity, if carried out during the day, is starkly evident. There are also safety and aesthetic issues for the commercial beach fishers as they use four-wheel drive vehicles to haul dinghies along increasingly crowded beaches.

2.5 Relative value of the activities

Commercial fishers consider they have an historic right to continued access to the estuarine and embayment fisheries, although their common law right of access has been progressively fettered by statute law over the last 150 years (Department of Fisheries 2005b). The recreational position is that, given the low commercial value of species in estuaries and embayments, commercial exploitation is not the best economic or social return for the resource; the best return to the community can be achieved through shifting the available catch to recreational fishers, e.g. in the salmon/herring fisheries.

3. THE INDUSTRY ADJUSTMENT PROCESSES

In 1983, government froze the entry of any further commercial fishing boats into the Western Australian fishing fleet. This effectively stopped further entry into those remaining (lower value) commercial fisheries for which limited entry regimes were not explicitly in place especially in estuarine and embayment fisheries. This measure effectively capped numbers in the inshore fisheries of the state. Although not explicitly aimed at resource sharing, the aim of government was to curtail future conflict between the inshore commercial fishing sector and the recreational sector. Government held discussions in 1985/86 with commercial fishing representatives. This became known as the "Mandurah Working Group". The group recognized that excess capacity in the fishing industry was raising concerns about the financial viability of fishing operations and impacts on fish stocks. The group found that "these difficulties are manifested by an excessive number of boats in small unmanaged fisheries causing local conflicts and fears for the continued viability of those stocks" (FINS, 1986, p12). This included the estuarine and embayment fisheries. The peak industry body wrote to the Minister for Fisheries (FINS, 1986) proposing that the number of boats (fishing units) in open access fisheries be reduced to: distribute the catch over fewer fishing units to increase the viability of the remaining fishing units; reduce the number of fishing units to prevent the release of latent fishing effort in the fishing fleets; and reduce the competition for the fish stocks to relieve the (fishing) pressure on the fish stocks being targeted and benefit all user groups, including the recreational sector.

The group proposed a licence buyback scheme, together with a greater level of management, through essentially introducing limited entry fisheries. The group believed that, if these measures were accepted, the benefits would flow to the whole community, reduce conflicts within and between user groups, and reduce pressure on government to resolve these conflicts. The group recommended that the cost of the licence buyback scheme be shared equally between the commercial fishing industry and the community, and proposed a levy per fishing unit that would be matched by Government funding as the community component. These views were generally accepted by the government and the Fisheries Adjustment Schemes Act 1987 (FAS Act) was introduced. This act had the capacity to raise levies from the commercial fishing industry. The Fisheries Adjustment General Scheme (General Scheme), which was established under the Act, raised an annual levy that was matched by government on dollar for dollar basis, and resulted in 118 fishing licences being surrendered; 64 were in south-western estuarine fisheries. The group recommended that the licence buyback be reviewed after five years. The peak industry body withdrew support for the industry levy, and hence the matching government contribution, in 1998 as it considered that the general scheme had achieved its objectives. The general scheme ceased in 1999.

Over the period 1986 to mid-1996, the general scheme withdrew a total of 187 inshore fishing authorizations, resulting in an overall reduction of about 10% of the commercial fishing fleet, with the current fleet now about 1 350 boats. This was the underpinning of subsequent adjustment processes explicitly focused on reallocation of fish resources. It succeeded in removing much latent effort in the inshore and estuarine sector. Given the age structure of the fishers, coupled with the restricted nature of transferability, it also provided a social 'safety net' or exit package for those wishing to cease fishing at relatively modest cost to the taxpayer and industry.

3.1 Application of the FAS Act

The Fisheries Adjustment Scheme (FAS) Act provides the mechanism for structural adjustment through the payment of compensation for the surrender of commercial fishing authorizations. The act provides for both voluntary and compulsory schemes, and sets the requirements for consideration of a when a fishery. When considering a voluntary scheme, the act requires the Minister for Fisheries to establish a cross-sectoral committee to provide advice firstly on whether there are grounds to consider establishing a scheme, and secondly to provide advice in respect to offers made to surrender fishing authorizations to a scheme. It is normal practice to have recreational and commercial fishing representatives, a delegate from the Department of Fisheries and an independent chair on the committees. The committee provides advice on the value of authorizations being offered to a scheme. The decision to establish a scheme, and the ability to accept offers or make counter offers, rests with the minister. The act provides options to have compulsory schemes or industry funded schemes, but these are not discussed in the present paper.

Voluntary schemes with a reallocation objective have not normally been applied to high value fisheries, as the compensation costs would be significant. These fisheries already have comprehensive management structures in place, catches are more predictable, and the fisheries are mainly cost recovered. High value fisheries where there is a significant recreational fishing component are currently the prime focus of the state's integrated fisheries management initiative, which is described elsewhere (Rogers 2006).

3.2 Schemes focused on resource reallocation

In 1996-97, government announced that funding would be available over four years for voluntary schemes to accelerate the reduction in numbers in key commercial fisheries – primarily the estuarine and embayment fisheries where there were resource sharing

conflicts. This funding initiative was launched in tandem with a process of mediation designed to obtain management outcomes to complement or supplement voluntary adjustment processes (Wright *et al.* 2000). Priority fisheries were determined by the minister after consultation with the peak commercial and recreational fishing bodies, and upon receipt of advice from the committees established for this purpose under the act. Schemes were then established in a priority order. The schemes specifically targeted commercial fisheries in areas of increasing population growth in the southwest where the community expectation is that there will be fish available for recreational fishing. The presence of commercial fisheries (for whatever reason) conflicts with the expectations of the general population in terms of recreational enjoyment. The use of schemes and payment of compensation was designed achieve a broader community objective. For the period 1987–1997 the number of fishing units was reduced by 41% in the five estuarine fisheries (i.e. Swan Canning, Mandurah, Leschenault Inlet, Hardy Inlet and South Coast estuarine fisheries). This was due to natural attrition and licence buyback through the general scheme (Pearn and Cappelutti 1999). Voluntary schemes resulting from the $8 million initiative saw a further reduction of 24 units (28%) from January to October 1998. Since that time, a further 33% of the remaining fishing units have been reduced leaving a total of 39 fishing units in these fisheries. Following the initial initiative, government has continued to provide fisheries adjustment funding through annual budget allocations.

3.3 Experience in the application of schemes

As is evidenced, Western Australia has a long history of running fisheries adjustment schemes, first through the general scheme, and then through a series of targeted schemes. Most have incorporated an aim to reduce intersectoral conflicts through permanent reductions in the number of commercial fishing units operating in these fisheries. The general scheme was the first voluntary scheme operated in Western Australia. It was established when there was already a market for the goodwill value of transferable licences. Initially the general scheme acted as a market follower, rather than a price setter. This changed over the life of the general scheme to a situation where prices offered through the scheme would set benchmark prices. In other words, as the market price for licences fluctuated (often quickly) prices offered by the scheme were more stable, and provided the 'fall back position' to fishers.

The licence valuation techniques used by the committees for schemes have been refined over time. In most cases, the minister makes offer prices based on a Net Present Value calculation of the annual return for the average licence in the fishery. This in general equated to about twice the average gross annual landed value. The minister will usually offer only one price for each round of a scheme. Certain general trends can be recognized in the administration of schemes:

- **Latent effort.** Most first rounds of a scheme remove latent effort, i.e. fishers who were seeking to retire from a fishery, through a combination of local social pressures, low economic returns, age/health related matters, and are seeking some 'remuneration' to realise the goodwill value of fishing licences.
- **Expectations about the value of a licence.** A price based on the average catch value is not attractive for active fishers at the higher end of a fishery, especially if there is a lot of latent effort in the fishery. As latent effort is removed permanently through a scheme the remaining fishers will seek increased prices for the surrender of licences in subsequent rounds because they generally generate income greater than the average and can lead these fishers to feel their licences are undervalued. However, for reasons of equity, common practice is for the minister to make standard offers to all fishers regardless of catch history. Making value judgements on the individual returns for each fisher is difficult, especially when the public purse is being used.

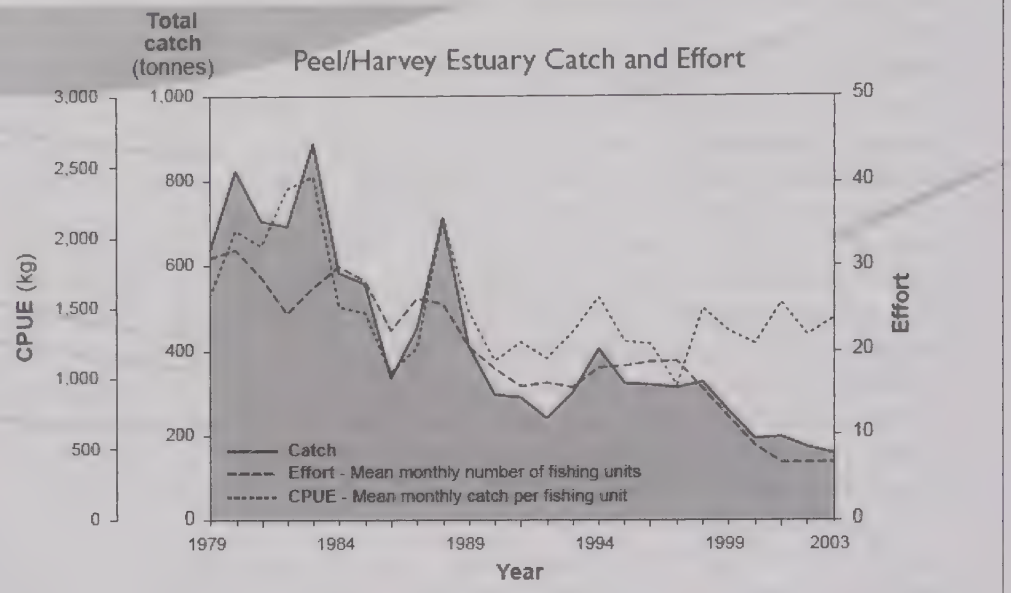
- **Wholesale removal of fisheries.** In one instance an entire fishery has been bought out in the first round, e.g. in the Leschenault Inlet Estuarine Fishery. Here, through escalating community pressure and declining environmental quality, there was a sound economic case for the fishers to decide to exit the fishery en bloc.
- **Influence of public policy.** A government objective of reducing the number of units in a fishery can have a direct bearing on the value of licences. In these instances consideration needs to be given to offering a premium on licence valuations, given schemes are voluntary and fishers are not required to either make or accept any offers. This can create a situation where a scheme needs to compete in the market place to attract offers, while taking care not to drive the market upward. Alternatively, schemes can provide realism into fishers' expectations of the goodwill value of their licences. There is often a misconception that the public purse is bottomless. The value offered for a licence can relate to the priority given, ultimately by government, to reducing conflict levels or the resource reallocation objectives given to a fishery, especially when considered against available funds for fisheries adjustment purposes. This is true when the impetus for a scheme comes from the commercial fishers themselves as a consequence of failing markets, poor catches or increasing competition from recreational fishers.
- **Relation to management objectives.** In providing advice on schemes, committees need to be aware of management arrangements for the fishery and proposed management changes after finalization of a scheme. The committees also have to consider the potential for other commercial fishers to "take up" the benefits of a scheme and effectively replace those fishers that have exited under a scheme, as well as their ability to shift effort to other fisheries where multiple licences are held. Similarly, committees must to consider the potential for schemes to "follow" fishers through a succession of schemes as multiple licences are progressively surrendered. It is better to adopt a position of not accepting the piecemeal surrender of licences at the outset. The complete removal of fishing units, with the appropriate compensation, should be the preferred option.

3.4 Outcomes

Significant reductions in fisher numbers have occurred in Western Australia's estuarine and embayment fisheries, with corresponding reductions in commercial catch, such as the Mandurah Estuarine Fishery (Figure 2). However, it is often not possible to measure a resource shift arising from these schemes. Average catches may increase in the commercial fishing sector because of environmental factors, variations in stock recruitment that may (or may not) be identified by research, economic factors, changes in markets, periodic shifts in fishing effort or the vagaries of weather. The greatest impact of schemes has been where the number of licences withdrawn has reduced commercial fishing numbers to very low levels. Where the remaining commercial fishers have been unable to improve technology or to significantly increase fishing days, there has been a real potential resource shift to the recreational sector. Unfortunately, not all the former commercial share will be available because of the declining ecological status of many of Western Australia's estuaries.

While there is a prima facie case for increased availability of catch for the recreational sector, quantifying the extent of any resource reallocation is difficult because of the lack of recreational catch data. This has raised questions of the value of adjustment and perceptions that remaining commercial fishers are the primary beneficiaries (Stagles 2005). Alternatively, the open-ended nature of recreational fisheries can mean any benefits are quickly absorbed into this sector, with little discernable benefit to the individual fisher. This is compounded by a small percentage of "top end" anglers who characteristically take the bulk of available recreational catch through a combination

FIGURE 2
Annual catch, effort and catch per unit effort (CPUE) for the Mandurah (Peel/Harvey) Estuarine Fishery 1978-2003.



of skill and persistence. These fishers are the immediate beneficiary of reallocation mechanisms (Kearney 2002; p 150). The recreational sector and government are now seeking material benefits (spatial or demonstrable) as an objective or consequence of schemes, largely because the recreational fishing community cannot discern any tangible benefits of previous schemes. These include the introduction of further recreational fishing only areas.

3.5 Unforeseen consequences

A key to success in fisheries management is the quality and quantity of biological and catches data available to provide contemporary stock assessments. These are also indicative of the general health of a marine environment. As commercial fishers are required to provide catch returns and are in dialogue with research and management officers, they provide the hard data and anecdotal evidence that management decisions are often based on. The Department of Fisheries relies considerably on compulsory catch and effort returns as a tool in determining fish stock status. Some of these datasets stretch back to the mid-1940s. The incremental reductions in commercial fishing unit numbers, while worrying in terms of reducing the sampling base, have still seen a stream of data available.

More serious to research has been the total removal of commercial fisheries, e.g. the Leschenault Inlet Estuarine Fishery. Anecdotal evidence is that recreational catches have not improved (at least not to the extent that the common perception of commercial fishers taking all the catch would suggest). However, in the absence of commercial catch data, the department cannot respond to requests for contemporary stock assessments. While recreational surveys are planned, they are, in comparison with commercial fishing data, expensive, time consuming, and periodic. Thus the sudden removal of commercial fishers can mean a source of catch data (often long term data sets) is lost, and can lead to a situation of having: no replacement data available for fish stock analysis and assessments; no replacement data systems in place to ensure continuity of data; and/or data sets that are not calibrated to ensure integrity of data for making management decisions for both commercial and recreational fisheries.

The government has therefore had to provide budget allocations for recreational fish surveys to compensate for a declining commercial database. It is also investigating instituting recreational angler logbook programs, as well as a range of surrogates for measuring fish abundance.

4. DISCUSSION

There is a paradox of allocation in Western Australia. The state currently has an integrated fisheries management initiative to initially target allocation issues in high value species, such as abalone and western rock lobster. There are known participation rates and an abundance of supporting data in these fisheries, making allocations easier. In contrast, the estuarine and embayment fisheries with a low economic value, valued lifestyle components and higher levels of conflict, through either competition for the available fish resources, perceptions of inequity or the physical presence of commercial fishing activities, are where allocation decisions are being made with cruder tools and less data.

Voluntary schemes are a means to shift resource share with the assumption that reductions in commercial fishing provide a corresponding increase in the available recreational catch. The voluntary nature of these schemes mean an outcome (at least in the short term) can be uncertain, but history shows they are effective in the longer term in achieving permanent reductions in commercial fishing effort. In Western Australia, a long-term program of operating schemes has enabled significant reductions in the number of commercial fishing units.

Significantly reducing these commercial fisheries reduces catch data available for research purposes. This must be addressed, given the recreational sector will continue to demand contemporary stock assessments, particularly if catch rates decline. In Western Australia, given the now relatively low level of commercial fishing effort in these fisheries, and their likely low percentage take of the total catch, the issue is becoming whether there is public benefit in further effort reductions, or whether the funds would be better spent in gathering higher quality data on recreational fishing effort and stock status.

Quantifying the success or extent of resource reallocations as a consequence of schemes remains problematical. Has there been an increase in the availability of fish stocks for recreational fishers in the estuaries and embayments since schemes commenced? Has there been an increase in the number of recreational fishers in these waters? And, has there been an increase in recreational catches as a consequence of schemes? There is no definitive answer. The ability to prove that a change in resource reallocation has occurred as a result of a scheme is difficult because of the lack of recreational catch data to coincide with the available commercial catch data, especially because the schemes may first absorb latent effort. The lack of apparent success in resource reallocation can cause the recreational fishing sector to seek tangible benefits from future schemes or management measures. However, there is benefit in undertaking resource reallocations through maintaining effort levels of existing commercial fishers and the removal of real and potential effort through schemes.

With the value of hindsight, reducing commercial fishing effort through schemes is a preliminary process, in place until the more fundamental issues of resource reallocation can be addressed. Alternatively, an objective may be to reduce a commercial fishery to a particular level, which is seen as a suitable compromise between the sectors.

These debates, seeking co-operative management arrangements between the commercial and recreational sectors, have not been widespread in Western Australia. This view is reinforced when a progressive historical view of schemes is taken. The objective of the general scheme was to provide the mechanism to generally reduce commercial licences across a broad spectrum of fisheries. This progressed to a series of targeted schemes, with no specific allocation objectives other than to reduce the

number of fishing units in key fisheries. This led to schemes where there is a clear political objective for a particular fishery, such as phasing out the commercial fishery. It is anticipated that there will be further schemes with specific resource reallocation objectives, which will presumably form part of the broader integrated fisheries management debate.

The opportunity cost of not having operated schemes needs to be taken into account in any consideration of the impact of schemes in Western Australia. While it is not appropriate to provide specific prices there is empirical evidence that the cost variation between similar licences surrendered under the general scheme when compared to more recent targeted schemes is significant – usually an order of magnitude. Having to now commence the resource reallocation process in Western Australia would be cost prohibitive. Voluntary schemes are not a new panacea to fisheries management or resource reallocation, but in Western Australia the demonstration of persistence, patience and foresight is showing tangible results.

5. ACKNOWLEDGEMENTS

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Hon. Eric Abetz
Minister for Fisheries, Forestry and Conservation
Australian Government
as represented by Barry Haase

Thank you Mr Chairman. Good morning ladies and gentlemen, may I especially acknowledge the Honourable Jon Ford, JP MLC, the Minister of Fisheries for Kimberley, Pilbara, and Gascoyne; the Honourable Bruce Donaldson MLC, Shadow Minister for Fisheries here in WA; Mr John Glaister, CEO of the Minister of Fisheries New Zealand, representing the Honourable Jim Anderson, Minister of Fisheries; Mr Feleti Teo, Foreign Fisheries Agency; Mr Ichiro Nomura, Assistant Director General Fisheries Department, Food and Agriculture Organization of the United Nations; Mr Omani Bohobasi; and Ken, I'd particularly like to recognize you. Thank you for your appropriate welcome.

I'm very pleased to hear today the opening comments at this Sharing the Fish Conference 06. The new Australian Minister for Fishery, Forestry and Conservation, Senator the Honourable Eric Abetz, sends his apologies for today and assures us he will be taking a very keen interest in all your deliberations.

I welcome you all to the great state of Western Australia. As has been mentioned by our chair, I am the member for the federal electorate Kalgoorlie and it is the largest electorate in the world, of little consolation when one is trying to cover that vast 2.3 million square km. It's worthy of mention I suspect, that rather than the area being noticeable in as much that it is approximately a third the land mass of Australia, its coastline – including bays and inlets – the coastline of my electorate is some 10 000 km. Even more surprising, if you take the coastline of the islands offshore of my electorate, that's another 6 000 km. So a total of 16 000 km if one were to consider the difficulties of sharing just that fish resource, you'd have cause for many, many headaches, so for all of you who are committed to the cause of discussing that over these four days, I encourage you and congratulate you.

My electorate has great mineral wealth that plays an important part in the Australian cattle and sheep industry, as well, and has many, many popular fishing and tourist destinations, If you think of the popular destinations across this wonderful state of ours, Ningaloo, Karijini, Bungle Bungle. Yes they're all in my electorate.

After the conference – if you can do so – I encourage you to stay and enjoy some of the wonderful attractions of this state. And now to business:

There's a broad range of representation here from the different groups with an interest in the fishing industries around the world. The diversity of interests you represent underscores the importance of the resource sharing issues that will be discussed over the next few days.

This conference is an important follow up to the FishRights Conference held in 1999 and will take a further step towards fairly and effectively resolving the issues associated with sharing resources among competing sectors. The conference will explore three main themes: the allocation of fisheries resources across jurisdictions, issues relating to the allocation of resources across sectors, and the allocation of resources within those sectors.

These things were chosen to give a broad view of the challenges and hopefully will result in positive solutions. Trying to find a way to preserve access for the greatest number of users while maximizing economic benefits and above all, sustaining them, is a great challenge for us all, but as experience is gained and the debate matures, it is proving to be possible.

If you look at the impact of fishing on the world's fish stocks...and the growth of aquaculture and seafood trade globally, you will see that the nature of fishing and

the consumption of fish products are changing. It may surprise you to know that in Australia for example, we now import around $1 billion worth of seafood a year. Most of that comes from Asia. The nature of world fisheries will continue to change because of sustained pressure on resources, the ongoing issue of overcapacity, and the growing demand for seafood in a more affluent and increasingly health conscious world. This calls for a strategic and targeted approach to fisheries management that covers global, regional and national issues

Internationally, Australia is considered to be a small global player in terms of the size of our national fisheries and high seas fishing activity, but we are the major coast state in the southern ocean, and we have a strong reputation as a responsible fisheries and natural resource manager. Australia contributes significantly to the management of fish stocks at a regional level and we are active participants in five regional fisheries management organizations. Australia tries not only to get a fair share of the resource of our domestic industry but to ensure that fish stocks stay healthy and are being sustained. Domestically the management of our fish stocks is shared between the commonwealth which manages outside 3 nautical miles and the states which manage in shore stocks.

The actual take or catch is shared among commercial, recreational, and customary fisheries each of whom has different priorities and needs. Some areas are also protected for conservation in marine parks which are used by the tourism industry. Sharing of benefits or simply the fish among the full range of interest groups in the community who all have somewhat different aspirations is a complex task. That is why the Australian government has established and is now implementing an agreed framework for sharing and management between sectors that use Commonwealth managed resources through 11 basic principles.

The first arrangement is for the tuna and bill fish stocks off the western Australian coast I'm sure information about this will be made available further during the conference. We're also working on developing arrangements for migratory species on the east coast of Australia and we'll need to deal with long-tailed tuna, a species that the Australian government has decided will become a recreational species in northern Australia.

Maintaining the health of global fish stocks is no easy task, as a number of you will have no doubt discovered, as illegal unreported and unregulated fishing has emerged as a real issue for all responsible countries. Australia has been at the forefront, calling for strong action to stamp out illegal fishing. We have strong domestic measures and work closely with other responsible nations and in national organizations who are equally concerned about this issue.

We have been a key participant and significant contributor to the ministry led task force on illegal unreported and unregulated fishing on the high seas known as the High Seas Task Force. This task force will hold its final meeting in Paris on the 2 and 3 of March this year, where a number of ministers, including the Honourable Senator Abetz, will consider a number of practical proposals aimed at preventing and deterring illegal, unreported and unregulated fishing on the high seas. The Australian government has now committed significant funds and efforts to stamp out fishing from illegal foreign vessels in northern Australian waters and the southern ocean territories of Herd and McDonald islands.

The southern ocean activity involves a trade in Patagonian tooth fish whereas the northern activity is largely a shark finning exercise, but increasingly we are seeing activity targeting ground fish stocks and of course reef fish also.

There are two issues central to resource sharing. First, one cannot control or manage illegal unreported and unregulated fishing on your own where management and enforcement involves shared stocks. Second, we are increasingly seeing the emergence of multinational business and companies who are engaged in trade for profit. The problem is how one deals effectively with these rogue companies.

FishRights99 was an excellent beginning, focusing on the use of property rights in fisheries management. Through this Sharing the Fish 2006 conference, we progress further to consider other sectors and their competing needs. The challenge for this conference will be to examine the resource sharing experiences from around the world, build on these experiences and knowledge, and learn from them. The task at hand is not an easy one but I encourage you to work together, find some common ground, and help each other learn through sharing your experiences and listening with open minds.

Let me conclude by saying how impressed I am at the attendance for this conference. I'm sure the speakers will provide an excellent overview of the key issues and set the scene for a healthy discussion. The opportunities that exist to help ensure equitable resource sharing arrangements and sustainable and profitable fisheries will be a major topic for your consideration. I thank the conference organizing committee for their hospitality and I hope you all find this an informative and productive conference.

Hon. David Benson-Pope

Minister of Fisheries
New Zealand
as represented by Dr John Glaister, CEO, Ministry of Fisheries, New Zealand

Thank you, Peter. Good morning. Firstly, I'd like to present apologies from the Minister. He's attending the high seas task force meeting that Barry talked about and focusing on illegal, unregulated and unreported fishing. Can I also say that the Ministry of Fisheries is very happy and honoured to be financially supporting this meeting and also to have a large number of their key staff here to participate in the conference. The title is significant and highlights challenges that we all face - that is, in sharing the fish.

New Zealand is best known for its quota management system and has a lot of experience in providing for allocation within the commercial share, with market values as a key driver. Not only did the quota management system progress fisheries management generally, but it's also provided mechanisms to resolve one of their greatest allocation issues, that of Maori Treaty Claims. Much of this has already been reported at the last FishRights Conference in '99. And we now have 95 species in the quota management system comprising 550 stocks. The quota system significantly is underpinned by world class science. Now our legislation talks about both sustainability and utilization. Further species that now come into the quota management system will be allocated by tender. So, it's fair to say that we're now in a position of not having to spend too much time on the allocation issues *within* the commercial sectors, and this is because we have allocated the rights and have now established a market system that allows the commercial rights to be traded within a sector. However, there's still much to do, with sharing the fish being a foremost challenge.

Like many countries, New Zealand still faces many cross-sector allocation issues. And I think this conference, as Mr Haase said, provides a great opportunity to provide feedback on more recent work, and from my point of view, more importantly, an opportunity to learn from you. So this presentation looks at international issues across jurisdictions, allocations in general across sectors and within sectors and areas I think we've made some progress.

So turning first to the international – geographically, New Zealand is isolated. The only coast boundary it has is that with its western-most island, Australia. I'd like to pause at this point. I'm reading the minister's speech from New Zealand and I found that remark gratuitous and insulting, because as we all know, Australia is really the north island of Tasmania, but back to the script.

The international component of our fisheries is becoming increasingly important with globalization, increasing demand for seafood generally, and the effects of distant water fishing nations. And I must point out here that New Zealand is in fact a distant water fishing nation itself. Issues of governance and allocation are fundamental to our attempts to successfully manage international fisheries, fisheries that are fished by more than one country.

Unfortunately, these issues can be even more difficult to progress and resolve in an international context where jurisdictional issues, the varying interests and capacities of participants, and ill-defined government frameworks pose significant challenges. Regional fisheries management organizations are a cornerstone of our international efforts to sustainably manage internationally shared fisheries. Most, if not all, however, are plagued by inadequate governance arrangements and are operating in a paradigm that pits national interests against each other to the detriment of effective fisheries management outcomes.

Consensus decision-making further hampers the endeavours of a number of RFMOs and can result in management decisions based around the lowest common

denominator, and I'm sure you'll all be familiar with some of those. New Zealand is actively working within the RFMOs to draw attention to and address these issues. At the second meeting of the Western and Central Pacific Fishing Commission in December last year, New Zealand emphasized the need for the Commission to start considering the issue of allocation and called for the development of a discussion paper on this topic, a proposal that was subsequently endorsed by the commission. Until such times allocation issues are resolved by the commission the incentives on member countries to maximize their individual interests in the tuna stocks managed by the Commission will undermine the Commission's ability to effectively manage these stocks. There a number of papers being presented at this Conference on the complex issues surrounding allocation within WCPFC, and there are a large number of Pacific Island countries in attendance. This all bodes well for progress on this issue.

New Zealand has recently hosted the first inter-governmental meeting on the establishment of a new RFMO for non-highly migratory species in the high seas waters of the South Pacific. Participants in that forum expressed their desire to learn from the experiences of other RFMOs to develop a new organization that reflects international best practice.

New Zealand will pursue the development of a robust decision-making process, and clear rules governing participation in the RFMO, allocation and participatory fishing rights, and how to deal with non-members. We will also be promoting mechanisms to ensure the new organization and its members are accountable for the performance of the RFMO in achieving its objectives with regard to sustainable utilization of fisheries and the protection of marine biodiversity.

A particular challenge will be in the development of allocation principles and rules for discrete high seas stocks covered by the RFMO. What is the nature and extent of coastal state rights relative to distant water fishing nations, and what are the rights of developing countries with respect to these stocks? Little guidance is provided in international law on these difficult issues.

In terms of other allocation work, a lot of effort is currently underway in New Zealand looking at how fisheries resources might be allocated between commercial, recreational, and customary interests. Work on much of this will be reported at this conference

How to 'share the fish' is a central issue for fisheries management in New Zealand.

Different jurisdictions have tried and are developing different methods and approaches to this, so I think much is to be learnt from hearing about the detail on that experience and discussing and exchanging views both during the conference sessions and more importantly, during those less formal opportunities.

I'd just like to share with you some Areas where I think New Zealand has made good progress.

Firstly, looking at spatial temporal allocation issues in aquaculture reform – over the last ten years there has been rapid expansion of aquaculture in New Zealand. In some regions aquaculture is now competing with existing commercial, recreational and customary Maori fishers for access to limited coastal space. How we manage the interaction between aquaculture and wild capture fisheries is important.

The speed and scale of this expansion has caused conflict between fishers and marine farm developers, and this led to the enactment of new legislation in 2004 providing for a more prescriptive approach to development. The legislation contains much that is innovative, including the provision for commercial fishers and marine farmers to negotiate voluntary agreements concerning where aquaculture can and cannot take place. And, this is through the adverse effects test and a market-based solution. The reform has also resulted in the settlement of claims by Maori to a proportion of water space. These are significant outcomes which have largely resolved conflict and provided the aquaculture and fishing sectors a firm basis upon which to build a shared future.

Oceans policy is another area that continues to be a challenge for us is the development of an oceans policy. For very good reasons, there's been a plethora of legislation that's evolved which has dealt with particular aspects of oceans, but that has resulted in legislation that essentially conflicts. Our oceans policy is still under development, but experience to date suggests there are a number of complex factors that will need to be addressed in order to progress an allocation policy for the oceans.

Fishing can coexist to some degree with other uses of the marine environment, such as the protection of natural character of the coast, marine farming and mining, but competition arises between uses as well as between fishers.

Competition should be resolved in a manner that is fair and leads to the highest value use of those resources, and issues that need to be addressed include how trade offs should be made between conflicting uses, the tension between secure property rights and flexibility to provide for change in uses, and how to provide for the national interest.

Allocation between commercial and recreational and methods to achieve optimum allocation – this is another area where a significant amount of work is occurring. As competition over access increases between commercial and non-commercial users of fisheries resources, existing approaches to providing that access come under pressure.

In that context, the ITQ based commercial regime is a seemingly obvious first base in intersectoral allocation and the division of the total allowable catch among the sectors. So what you have are quite tightly held individual commercial rights versus a recreational collective right. So, we're talking about dollars versus whatever the recreational values, whether it be larger fish or high sea sightings per unit effort (SPUE). The market can deal with the dollars but how to get the market to deal with the recreational aspirations is the challenge. However, gaining agreement to a set of criteria that would deliver reasonable certainty over how individual fisheries would be handled has not yet been achieved. And I believe this certainly is the key to it. A finer-grained approach may be required, using a mix of management tools that can be combined to address both large scale issues of access, and more localized issues of value enhancement and intersectoral conflict.

An optimum allocation of the available catch to recreational and commercial interests is central to maximising the value of shared fisheries. We are currently examining the methods used to set and alter the sectoral shares, focusing in particular on the methods used to assess, and respond to, changes in the recreational value of a fishery.

Basically now to conclude, I'd like to say, that New Zealand I think has made a good start. Having been there for just over 12 months, I can tell you that I can see the benefits of the support of a commercial sector and what that can mean. At the RFMA meeting the other week, the minister announced that a benthic protection area proposal that had been proposed by the industry was on the table. Now this came about in June last year, the Ministry went to the commercial leadership and said that we were interested in progressing debate on the environmental effects of fishing this particularly around metals and sea birds.

The industry responded by saying that "we're interested in looking at broader issues" and came up with an idea of a marine protected area proposal. The criteria they are looking at would be that it would be significant size, be representative of the different habitats, and permanent under the fisheries act. The sort of selection criteria they'd looked at was that the areas would be unmodified, so essentially untrawled, that there would be representative of EEZ geographic regions depths marine environmental classifications and underwater topographical features, or seamounts, that they would be large, simple in form to optimize compliance, and consistent with the government stated policy of 10% protected area. So there was a draft prepared in December last year, and the ministry had a look at the draft and made some suggestions including looking further at the depth ranges, productivity, full representation of marine classification areas, and the latitudinal and longitudinal spread.

The proposal that came back last week is to put simply, extremely bold. New Zealand has the 4th largest EEZ in the world, and to give you some idea, the area proposed includes 31% of the New Zealand EEZ, includes 42% of all the seamounts. It will be the largest marine protected area in the world if it proceeds. To give you some idea of the scope, if you took the average EU coastal state and its EEZ, this area proposed is double that. So what the minister has agreed to is to go out for a consultative process, which will happen pretty soon, allow input from all the interested groups, and then move to legislation. I'd be happy to share this in further detail with anyone that's interested during the conference.

I'd like to finish by saying I think the QMS great from New Zealand, but it's really almost in the nature of an unfinished symphony. The real application through market mechanisms has been extremely successful within the commercial sector, albeit there has been a lot of pain along the way, but the challenge now is in those shared fisheries which occur across sectors, which I'm sure that's a problem that is common for us all.

Thank you.

Ichiro Nomura
Assistant Director General
Fisheries and Aquaculture Department
Food and Agriculture Organization of the United Nations

It is a great honour and pleasure for me to be with you at this conference, and to have the opportunity to share my thoughts about an inherent part of fisheries management, namely, the issue of allocation,

I commend the Governments of Western Australia and of Australia and the Ministry of Fisheries New Zealand for their vision in organizing an event such as this. It is an enormous and consuming undertaking. Indeed, it is a great tribute to the foresight of the Fisheries Department of Western Australia to be hosting another significant and globally relevant fisheries management conference just six years after hosting FishRights99, Use of Property Rights in Fisheries Management – a conference in which FAO similarly cooperated.

As I think about the impressive achievements of our host institutions, as well as those of the distinguished participants of this conference, I am looking forward to the constructive and positive dialogs that I believe are about to take place. I think that we will have an extremely productive conference that looks at the sometimes – no, let me rephrase that – the frequently difficult and often contentious topic of sharing our limited fisheries resources.

The topic of allocation – how we can share, portion, allot, distribute – is at the heart of any and all of our efforts around the world to manage fisheries in ways that enable us to sustainably utilize our fisheries resources. Thus, it is the aim of this address to look at: how we have addressed – or not addressed – the issue of allocation; the challenging aspects of sharing our fish, and, looking to the future, what we need to do to ensure the sustainability of our fisheries resources around the world.

How have we addressed allocation issues?

Looking back, we see that culture and societal norms have played a significant role both in allocating – and in not allocating – fish.

Customary marine tenure systems, like those in many of the isles of Oceania and as discussed last week during the FAO Pre-Conference Workshop on the Ways and Means of Allocating Resources, set clear rules for participating in and sharing the bounty of these communities' fisheries.

Elsewhere, such as in Brazil, community-based systems evolved to provide de facto rules for participation and harvesting by establishing informal spatial rules that applied to fishing spots or areas along the coast – enforced simply by virtue of a strong social notion of respect ("respeito") – and by which fishermen of the community would abide.

In my own country of Japan, centuries of traditional custom and social norms set very strong boundaries determining who could catch which fish and where.

Unfortunately, unless conscious efforts have been made to transform these rules into contemporary law – the weakness and legal informality of these rules has been revealed when they have collided with another rule – the rule of competition or, as some call it, "First in, best dressed."

In such cases, the norms and rules of one community may not be upheld or respected, especially by those outside the community. Instead, it is the "cowboys" who daringly push their limits to be stronger, to work faster, and to stay out longer – even when they may not be wise to do so – who hope to reap the rewards of outcompeting others.

Elsewhere in the world, where the bounty of the oceans once seemed endless, the question of "Who gets what?" didn't enter into the equation and was not considered a worry. With a seemingly limitless supply of fish, all that stood between the fish and the plate was the captains and crews willing to get out there among it to catch and

deliver the fish. A means of apportioning finite catches did not come into the picture – nor did it appear to need to be considered. But that, too, changed when commercially important stocks started declining faster than technological innovations in harvesting could make up the difference, and it became clear that the fisheries were overfished.

Ironically, although we can find examples all over the world of boom-bust fisheries, we do not seem to have managed to break ourselves of making the same management mistakes. We still tend to fall victim to the habit of applying regulations that hamper the efforts of fishermen to catch fish and that make catching fish harder, more dangerous, and more costly. We still tend to approach fisheries management with the mindset of trying to put brakes on fishermen as they go about harvesting fish.

This approach, however, has not prevented overfishing or overcapacity. Instead, it has provided inspiration to engage in illegal, unregulated, and unreported (IUU) fishing and resulted in economic waste, social strife, and, in some cases, degradation of the environment. Moreover, this approach does not provide an answer to the question of how to share the fish.

Another way of saying this is that, in most fisheries around the world, we have only implicitly addressed the issue of allocation. We have not focused on designing management systems that clearly decide "who gets what" and that let fishermen get on with their business of determining how best to catch the fish. Instead, and in lieu of this, we avoided the question and have taken advantage of – and put at risk - the resilience of the resources in our oceans, coasts and inland waters.

Times have changed, and we can no longer ignore the questions of how to share our limited fisheries resources and how to determine who can catch what, however sensitive these questions may be. Indeed, the longer we avoid implementing allocation mechanisms, the more we risk making decisions that, ultimately, do not lead to fisheries that are as healthy as they could be.

The challenging aspects of sharing our fish: one may ask, "Why is the question of sharing the fish such a sensitive one?" Allocation is a sensitive topic because it means making explicit social, political, and economic decisions.

To help solve this problem, the FAO Code of Conduct for Responsible Fisheries provides principles for framing such difficult decisions. Policy-makers and managers are urged to take into account the social implications of their policies and regulations and, when determining the uses of coastal resources and governing access to them, to take account of "the rights of coastal fishing communities and their customary practices..."[2]

Additionally, the Code states that "In order to assist decision-making on the allocation and use of coastal resources, States should promote the assessment of their respective value taking into account economic, social and cultural factors."[3]

The unfortunate reality is that we are still struggling with the practical means, the mechanics, of how we go about taking these factors into account. It is simply not feasible to try to make all allocation decisions on an administrative or political case by case, fishery by fishery basis because the time it takes to make decisions in this way is usually far greater than what the stocks and the fishermen can withstand.

Socially and politically, allocation means making painful decisions about who will catch or produce fish and about who will have to be excluded. There simply are not enough fish in our capture fisheries to go around to constantly growing and expanding populations. Yet, at the end of the day, how does one explain to a hungry child that there will be no fish to eat because the fish have been allocated to someone else, for example, in order to bring in revenues to the government to help build the country's infrastructure?

Similarly, there are important economic implications of allocating fisheries resources.

[2] Article 10.1.3.
[3] Article 10.2.2.

How much efficiency do we want? Do we simply set up systems that let the markets determine "who gets what"? Alternatively, do we make the conscious decision to let our fisheries be less than fully economically efficient? We can design allocation systems that follow a moderate path that takes social, cultural, and economic factors into account but which, when all is said and done, leaves most of the allocation decisions to the participants to sort out among themselves.

Regardless of how we choose to proceed, we are at the point where we need to deal actively and conclusively with the issue of sharing and with the allocation implications of different types of management approaches – before IUU fishing and conflicts over who gets the fish escalate to a point where allocations decisions have to be made under duress. This is why the Code of Conduct says that "States should facilitate the adoption of fisheries practices that avoid conflict among fisheries resource users and between them and other users of the coastal area."[4]

In short, the challenge before us if we are going to sustainably develop and utilize our fisheries resources, if we are going to leave our children's children their due inheritance, we must address the question of "Who gets how much of which fish?".

What do we need to do to ensure the sustainability of our fisheries resources around the world?

There are three lessons that we have learned over time.

First, is the lesson that fisheries are finite – and, as a result – our catches have to be similarly finite.

Second, is the lesson that participation in fisheries has to be finite. That is, access to capture fisheries must be limited.

Third, is the lesson that even if we limit access and limit participation, we can still overfish our fisheries. Thus, it is not enough to limit participation and to limit catches. There also has to be a sharing mechanism that determines clearly who gets what. Only with this can we create an environment in which people have real reasons to be inspired to be stewards of their share of particular resources, to tend and utilize them carefully and sustainably.

What is this sharing mechanism? It is something that FAO and others have been working on and advancing for more than a decade: the establishment of fishing rights that people can hold – either as individuals, as stakeholders, and/or as communities.

Fishing rights explicitly address the issue of allocation and sharing. Moreover, holders of these rights have every reason to guard the value of their asset by not overfishing and otherwise degrading it – thereby aligning economic forces with conservation interests.

Now, this does not mean a one program of rights fits all fisheries. The ways and extent to which fishing rights can be useful – be they individual, stakeholder- or community-based fishing rights – will depend on the setting in which they are applied and on the design of the rights system.

Nonetheless, from the community-based rights systems in Phang Nga Bay, Thailand and the village run Fishery Conservation Zones of the Mekong in Lao PDR, to the marine exploitation areas in Chile and the Beach Management Units of Lake Victoria, rights-based systems are being implemented to explicitly address the fundamental question of allocating fish.

In conclusion, if we are going share our limited fish, we need to have a straightforward and practical approach for determining who gets which resources. In short, fishing rights are required if we want to explicitly address and resolve the issue of allocation.

I look forward to the next few days as productive ones that will help us develop and extend current thinking on how we may all go about Sharing the Fish.

Thank you very much.

[4] Article 10.1.4

Official opening

Hon. Jon Ford JP MLC
Minister for Fisheries
Government of Western Australia

Thank you, and thank you all for coming here today and welcome.

Be aware, I am the Western Australian Fisheries Minister and you're about to get 5-10 minutes of me telling you how good we are over here. That is our way and we don't mind having a bit of a brag; we're not perfect but we're pretty close to it. I'd like to acknowledge Mr Ichiro Nomura, Dr John Glaister, Dr Fliti Theo, Mr Barry Haase MP, Dr Peter Rogers, is my executive director of the WA Department of Fisheries, Mr John Wilson, Australia Research and Development Corp, Mr Max Ball, who is the chair of the Western Australian Fishing Industry Council, the MG Kailis Group of companies, representatives from the Queensland's Department of Primary Industries and Fisheries, South Australia's Department of Primary Industries and Resources, Northern Territory's Department of Primary Industry, Fisheries and Mines, keynote invited speakers, my parliamentary colleagues, and ladies and gentleman, I'd also like to pay particular appreciation to Ken Colburn for coming here today and giving us that welcome, and I'd also like to thank Peter Millington and his team for putting on such a great show.

It's a pleasure to be here and on behalf of all Western Australians I'd like to extend a special welcome to all conference delegates, particularly those who have travelled great distances to be here today. I hope you enjoy your time in Western Australia and that you will come back again to enjoy this wonderful state and its wonderful natural assets that stretch right across the state including our diverse and spectacular fisheries and marine environment. When you do, no matter how far into the future, I'm certain that Western Australia will still be boasting of our ability to catch a fish for feed, the clean waters into which we can dive and marvel at the biodiversity of marine species, or simply the fish available at market for an affordable price – it didn't take me long to start into the bragging, did it? And if you are lucky enough to live in one of the countries which WA exports seafood, you will always be able to enjoy our lobster, prawns, scallops, Atlantic and finfish.

I say this because successive Western Australian governments in partnership with our fishing industry, our recreational fishers and our broader community have worked to ensure, in fact all of them have insisted, that WA fisheries can be counted among the best in the world. Of course ensuring that our fisheries and marine ecosystems remain healthy and productive is a result of good management underpinned by sound scientific research, and this vital management component is supplied by the WA Department of Fisheries and led by Dr Peter Rogers and western Australians are indeed fortunate to have Dr Peter Rogers' stewardship of our fisheries. Consequently I'm confident in stating that WA has a reputation as a world class fisheries manager.

In fact WA is a typical example of the importance of fisheries in communities throughout the world and why these fisheries are worth preserving for our future generations. In WA, as is the case elsewhere, our fisheries provide both industry and employment and a form of recreation and relaxation where families can drop a line together on a weekend and catch a meal. Our government has realized that by ensuring that WA fisheries are among the best in the world, we thereby guarantee income for

our producers' livelihood for our workers and contribute to the sustainability and uniqueness of our coastal and regional communities. Barry earlier told us just how extensive our coastline is and of course we have many, many communities that rely on the fishing industry around that coast.

Decisions about allocations, how much is fished and by whom is fundamentally a problem with sustainability. These decisions are made to ensure the long-term survival of our natural resources, but these decisions are more than a scientific theoretical exercise – these decisions affect economies, communities, culture, and individuals from workers who rely on the industry for their living wage to families who rely on fish as a healthy part of their diet. I'm pleased to say that in Western Australia I feel a strong sense of partnership between all of us who benefit from our fisheries.

When we have arguments about excess and allocation which I admit can be very robust and forceful from time to time – the arguments are always directed towards a sustainable outcome. What is sustainable? Is the science reliable? How to reallocate and maintain the sustainable catch? But fundamentally I'm proud to say that all of us – government, industry, recreation, all those sectors – are moving in the right direction.

I can give you one important initiative in Western Australia as an example: integrated fisheries management, or IFM, is a way of managing fisheries that enable a variety of user and interest groups, commercial fishing, recreation fishing, indigenous, conservationists, and indeed the wider community to plan together and share resources for the benefit of all Western Australians.

Even though the details hardly disputed, it has been welcomed and supported across government by all political parties as a better way of managing fisheries and fish habitats. IFM and the IFM strategy, which was launched in 2001, was believed to be the world's first at the time. Since then we have moved along considerably, the strategy has evolved into an active method of management. And IFM is well on its way towards implementation, with a draft allocation report for Western Australian's western rock lobster fishery, released for public comment in 2005. This is soon to be followed by a draft allocation report on the abalone fishery and after that, the west coast demersal finfish fishery. The WA Department of Fisheries is also preparing draft plans for government to consider how resource sharing sustainability issues can be addressed in the other WA fisheries.

Western Australia was also one of the first states in Australia to respond quickly to the to the Commonwealth Australian government's call to meet the challenge of ecologically sustainable development and developing national standards for ESD reporting. Western Australian Fisheries Resources Management Act 1994 already has in its objectives the application of ESD and all its fisheries.

As a responsible agency, the Department of Fisheries plays its part in the WA government's sustainability strategy because it has an effective regulatory system, the technology and resources for monitoring and reporting, as well as strong cooperative partnerships with industry in the community. Our government operates from a strong science base, with robust historical data and sound fishery monitoring regimes.

The caring for fish in their environment, ensuring the allocation of fish resources equitably, is not an easy task especially when there are such diverse fish stocks distributed across a massive area of continental shelf along our state's 12,000 km coastline. The Department of Fisheries also has to administer over 35 commercial fisheries that are designated in law as major fisheries and 15 fisheries that are under various management regimes. In addition, recreational fishing is an increasingly popular pastime in WA with about 1/3 of our population who will drop the occasional line or net, and if those international guests will notice we Australians have an obsession with the coast, as I said, in my electorate, although my electorate isn't as big as Barry's, it's 1.97 million square km. There are only 67,000 people who live in that. All the rest live on the coast. Of course all those people also have an interest in how WA fisheries are managed. We

are working with all of our fishery user groups to ensure we have plenty of fish for the future, since the advent of ESD reporting and fisheries management, every impact on the state's fish stocks or their environment has to be system reported. This requires a new approach and new management strategies based on cooperation on the sharing of knowledge across jurisdictions in Australia, and between and within sectors.

In fact, our sustainable fisheries can even be a valuable marketing tool. A sound fisheries management framework for the commercial sector allows scope for innovation and evaluating that enables WA to keep pace with an increasingly competitive international market. Many of our commercial fisheries consistently encourage market development and trade prospects using the powerful marketing and economic benefits provided by a sustainable fishery. More exposure to international markets with a good product that can be promoted as clean and sustainable can only help promote WA and provide yet other benefit of industry cooperation across all sectors.

Some of you will be aware of our western rock lobster fishery which is the most valuable single species managed fishery in Australia worth between 150-300 million Australian dollars a year. This lobster fishery was one of the first fisheries in the world to be certified as ecologically sustainable by the UK-based Marine Stewardship Council. To achieve this certification required considerable and real cooperation between fisheries management and industry. Rigorous measures have been put in place to make sure the rock lobster industry can be sustained while meeting the increased demand for this valued crustacean. The western rock lobster managed fishery might be the only one in WA to be certified by the MSC at this point, but there are many other fisheries in our waters are fishing sustainable. For example, our fisheries have received many excellent third party report cards for their sustainability from the Australian government. Under the Environmental Protection and Biodiversity Conservation Act 1999, a total of 29 WA Fisheries have been assessed and passed, thus achieving certification for export approvals.

Key to ensuring the sustainability of our fisheries has been resolving the critical issue of how our stocks are allocated. As Minister of Fisheries in WA, I have overall responsibility for determining and overseeing the processes, timelines and final decisions on allocations for user groups.

In Western Australia there's been a need to identify use of fish by indigenous people for customary purpose within its approach to integrated fisheries management. As a result of an extensive program to recognize and include indigenous people in the protection, sharing and use of fishing resources, allocation of fish for customary fishing has been recognized as a priority in the IFM process. In thinking about allocation of fish resources we need to appreciate that particular fish stocks are valued differently by different communities and fishing sectors, for example some finfish species such as the Sampson fish, have a low commercial value but are highly prized by the recreational community for their size and finding abilities, so much so that international tourists travelling to Perth for the specific purpose of catching one of these fish, and we actually encourage any sporting nation that comes here to go and try and catch them before they come in place, because it's at an advantage.

The same can also be said in the international sphere where a species such as a whale shark which is of iconic tourist value in Australia is a source of food in another. This is an example of a complex resource sharing issue arising from different community values. Other species such as WA dhufish are iconic species for both the recreational sector and the commercial sectors, prized for their eating quality, size, and value. However, I'm very keen to say that the commercial fishing industry, recreational fishers, charter operators and indigenous fishers work together on allocation and resource sharing issues.

Through IFM, and other initiatives, the WA government has created the framework for all their stakeholders to approach each other amicably, in good faith and to help

resolve these issues together. But cooperation between domestic governments and stakeholders is not the only way we can work together to ensure the sustainability of our resources. It is vital we work together internationally both as fisheries managers and trading partners. Last year while visiting Britain and Norway, and through talks with the European members of the fishing industry and fishing managers, I concluded that many of the European nations were so busy dealing with resource sharing issues across international jurisdictions that they had not been able to focus on resource sharing between their commercial and recreational sectors. This isn't called having a go at the European nations. Over here of course, because of our environment, we haven't had to deal with international jurisdiction issues seriously and that may be the reason we are having a problem with our international resources at the moment because nationally we haven't focused on that seriously enough. But it gives an example – of course you will all be aware of how the environment plays an important role in how we envision we focus on our fisheries and how we manage them

This conference, like its FishRights predecessor in 1999, is therefore the perfect opportunity for everyone to come together in a spirit of goodwill, to think out loud, to share our problems our views and our solutions to the issue of sharing our fish stocks.

Sadly, it is the case that international cooperation can be undermined by the scourge of illegal fishing, an issue that affects many countries including Australia. Western Australia is a relative isolated part of the world and is facing a massive increase in illegal fishing within our northern waters. These foreign fishing incursions into Australian waters reflect the current international experience where wild catch fisheries of many countries are being pushed through the limit through illegal fishing on the high seas. Illegal fishing is a grave matter and one I feel most strongly about. When reports were being made in late 2005 that more than 20 illegal vessels a day were being sighted in our Western Australian northern waters I was so concerned that I raised the issue as a matter of national importance. In fact, I'm advised that a number of our northern fisheries are facing extinction in the next 3-5 years at the current rate of depletion.

Our government and the government of the Northern Territory joined forces developed a joint strategy to tackle head on the illegal foreign fishing in Australian waters. This plundering threatens the livelihoods of commercial and traditional fishers who depend on the sustainability of our fisheries. We have and will continue to push for a national cooperative approach to the serious problem. But increasingly, our government has had to divert resources to its fisheries in the northwest because illegal fishing activity has become a daily occurrence and is now a major threat to the sustainability of our fish stocks.

So how do we share and protect fish resources? It really is a complex balancing act, and with so many different players and so much at stake, and if it is not done well, we lose our fish. If we do not work together nationally and in concert with our neighbours to taking urgent and immediate protect some of our threatened fish stocks, then perhaps soon it will be too late. There is an enormous complexity and difference in resource sharing issues worldwide; however, it is my belief that cooperation and negotiation focused on sustainability and underpinned by scientific research may well be the key to all of them.

I say this based on the premise that sharing the fish is not an issue of whose cultural and economic need is the greatest; it is about making sure fish and fish habitats are protected. Natural resource management across the world is rapidly changing in the face of population growth, technological advances, climate change and the subsequent high demand for resources. The issue of allocating shares of a natural resource is one of paramount and increasing interest to all of those involved in fishing and fisheries management. It is complex, but achievable. Under the Western Australian Department of Fisheries 5 year strategic plan, it can be seen that we are meeting challenges to

ensure sustainable fisheries resources, integrate fisheries management with the broader principles of ecosystem based management while applying ESD principles, facilitate equitable access to fish resources and encompass fisheries research and management into the evolving state-wide natural resource management framework. This has been achieved through blending science with practical experience with fisheries management with fishes, indigenous, commercial, and recreational.

This conference will assist in advancing new ideas. Together, we will advance ways to preserve the natural resources that our communities have come to rely on. I hope that all conference participants will benefit from its focus on a broad spectrum of allocation issues, presented by speakers from all around the world, representing government, the fishing industry and those with a stake in fisheries, fishing, and the marine environment.

You have the opportunity during this conference to gather information from 90 world class presenters and contributing your own ideas through the plenary sessions and workshops. You have all come with the intention to help resolve fit resource allocation issues and to look for ways of increasing international cooperation the sake of developing and maintaining sustainable fisheries world wide. When one species is exploited to extinction, there will be an inevitable search for another fish to grace the table and so the cycle will continue unless we all develop proactive strategies to ensure that we fish for the future.

Remember sharing the fish is about protecting fish and fish habitats so we can all have our piece of the pie, particularly for our future generations. You have a great amount of exciting work from now until the conference concludes on Thursday, so I wish you all a productive and enjoyable few days.

Once again welcome, and thank you all for your contribution to this important conference. It is with great pleasure that I officially declare the Sharing the Fish 2006 Conference open.

Thank you very much.

THEME 1
Allocations across jurisdictions

Allocating fish across jurisdictions

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ABSTRACT

The world's fisheries are in a time of grave crisis. Most of the fisheries that have produced bountifully in the past are now overfished, with many species facing commercial extinction. To respond to this situation, the world community adopted the 1995 Straddling and Migratory Fish Stocks Agreement, and since then several regions have adopted innovative regional fishery agreements. The most ambitious of these new agreements is the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Central and Western Pacific Ocean, which was adopted in Honolulu on September 5, 2000. This treaty, like the 1995 Agreement, adopts the precautionary principle as its main guideline. It requires countries to engage in data collection and data exchanges to promote transparency. It creates a Commission to allocate fish stocks. The Commission must make some decisions by consensus, but for others will utilize a chambered voting system whereby the distant-water fishing countries and the island countries must each agree by an enhanced majority before a decision can be adopted. To provide further protection for each country, the Convention authorizes countries to seek judicial review of any Commission decision if the decision is thought to violate the Convention, or the 1995 Agreement, or the 1982 Law of the Sea Convention. This Convention is now in force, and its operations will be monitored closely to see if its ambitious and important goals can be met.

One of the central missions of this Convention and other regional fishery management organizations is to allocate fish among its contracting parties. This paper discusses the criteria that should be considered when making such allocation decisions.

1. WORLDWIDE CRISIS IN FISHERIES

Our generation has awakened to a worldwide crisis in fisheries that demands immediate and urgent attention. The decimation of fish populations around the globe has been well documented,[5] but a few examples help emphasize the urgency of the present situation:

- Scientists now understand that without "highly precautionary management," most deep-sea fisheries are unmanageable, because the characteristics of deep-sea

[5] David E. Pitt, Despite Gaps, Data Leave Little Doubt that Fish Are in Peril, N.Y. Times, Aug. 3, 1993, at C4, col. 1 (nat'l ed.). See generally Freedom for the Seas in the 21st Century: Ocean Governance and Environmental Harmony 13-22 (Jon M. Van Dyke, Durwood Zaelke, and Grant Hewison, eds., 1993). Among the stocks that are now seriously depleted are Atlantic halibut, New Zealand orange roughy, bluefin tuna, rockfish, herring, shrimp, sturgeon, oysters, shark, Atlantic and some Pacific Northwest salmon, American shad, Newfoundland cod, and haddock and yellowtail flounder off of New England. Associated Press, Steps Must Be Taken to Counter Overfishing, United States Panel Warns, Honolulu Star-Bulletin, Oct. 23, 1998, at A-19, col 2 (quoting from a study led by Stanford biologist Harold Mooney and funded by the National Research Council, an arm of the National Academy of Sciences.).

species – "long-life spans, late maturity, slow growth, and low fertility" – make them particularly vulnerable to overfishing.[6]

- Recent research has revealed that deep-sea species in the northern Atlantic are on the brink of extinction because of large-scale bottom trawling. "A recent study on the Scotian Shelf cod stocks in the North Atlantic reveals that they are now four percent of their estimated biomass in 1853, with most of the drop occurring since World War II."[7] Other cod stocks in the North Atlantic are now at less than ten percent of their original biomass.[8] After the collapse of the cod stocks in the 1980s and 1990s, bottom trawling became common, causing some stocks to plummet by 98 percent in one generation, putting them into the "critically endangered" category.[9] Scientists have been trying to bring this problem to the world's agenda – and in February 2004, more than 1,000 marine scientists issued a statement expressing their "profound concern...regarding the unsustainable nature of many deep-sea bottom trawl fisheries on the high seas, and the physical destruction wrought by bottom trawling, including damage to rare and endemic species and critical habitats."[10]
- Fisheries in the exclusive economic zones of the United States remain dangerously depleted, and members of the United States Ocean Commission and its private counterpart, the Pew Commission, issued a recent report saying that if immediate action is not taken the crisis will become irreversible in five to seven years.[11]

The international community has developed global and regional treaties, but practical decisions must be made regarding how best to determine how many fish of each species can be harvested each year, how to determine how much of this amount each country should be allowed to harvest, and how to enforce the decisions that are made.

2. THE 1982 UNITED NATIONS LAW OF THE SEA CONVENTION

The acceptance by the negotiators at the United Nations Convention on the Law of the Sea[12] of the simple direct and elegant language of Article 192 marked a turning point in the human stewardship of the ocean: "States have the obligation to protect and preserve the marine environment."[13] Each word has importance and power. The operative word "obligation" makes it clear that countries have positive duties and responsibilities and must take action. The verbs "protect" and "preserve" reinforce each other, to emphasize that countries must respect the natural processes of the ocean and must act in a manner that understands these processes and ensures that they continue for future generations. The "marine environment" is a purposively comprehensive concept

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[6] K. M. Gjerde and D. Freestone. 2004. Unfinished Business: Deep-Sea Fisheries and the Conservation of Marine Biodiversity Beyond National Jurisdiction: Editors' Introduction, 19 International Journal of Marine and Coastal Law 209, 210-11 (2004); see generally Lee Kimball, Deep-Sea Fisheries of the High Seas: The Management Impasse, 19 International Journal of Marine and Coastal Law 259.

[7] K. M. Gjerde. 2005. Editor's Introduction: Moving from Words to Action, 20 International Journal of Marine and Coastal Law 323, 326.

[8] Id.

[9] Earthweek: Deep-Sea Damage, Honolulu Advertiser, Jan. 8, 2006 (citing an article by Jennifer Devine of Newfoundland's Memorial University in Nature).

[10] Gjerde & Freestone, supra note 2, at 211 (citing Protecting the World's Deep-Sea Coral and Sponge Ecosystems, at <http://www.mcbi.org/DVC_statement/sign.htm>).

[11] United States Gets D+ Grade for Ocean Policies, Honolulu Advertiser, Feb. 5, 2006.

[12] United Nations Convention on the Law of the Sea, Dec. 10, 1982, U.N. Doc. A/CONF.62/122, reprinted in 21 I.L.M. 1261 (1982) and The Law of the Sea: Official Text of the United Nations Convention on the Law of the Sea with Annexes and Index, UN Sales No. E.83.V.5 (1983). As of the fall of 2005, 149 countries had ratified the Law of the Sea Convention.

[13] See generally Jon M. Van Dyke, International Governance and Stewardship of the High Seas and Its Resources, in Freedom for the Seas in the 21st Century, supra note 1, at 13-22; Jon M. Van Dyke, Sharing Ocean Resources in a Time of Scarcity and Selfishness, in The Law of the Sea: Inherited Doctrine and a Regime for the Common Heritage 3-36 (Harry Scheiber ed. 2000).

covering all aspects of the ocean world – the water itself, its resources, the air above, and the seabed below – and it covers all jurisdictional zones – internal waters, territorial seas, contiguous zones, exclusive economic zone, continental shelves, archipelagic waters, and high seas. Article 192 thus recognizes the profound responsibility that all countries have to govern the oceans in a manner that respects the marine creatures that inhabit them. The marine environment must thus be preserved for the benefit of those who will come later to exploit its resources, to study its mysteries, and to enjoy the many pleasures that the oceans offer us.

The provisions of the 1982 U.N. Law of the Sea Convention regarding fisheries are general in nature but nonetheless clearly articulate an overarching duty to cooperate in all situations involving shared fisheries. Article 56 recognizes coastal state sovereignty over the living resources in the 200-nautical-mile exclusive economic zone (EEZ), but Articles 61, 62, 69, and 70 require the coastal state (a) to cooperate with international organizations to ensure that species are not endangered by overexploitation; (b) to manage species in a manner that protects "associated or dependent species" from overexploitation; (c) to exchange data with international organizations and other nations that fish in its EEZ; and (d) to allow other states (particularly developing, land-locked, and geographically disadvantaged states) to harvest the surplus stocks in its EEZ. Article 63 addresses stocks (or stocks of associated species) that "straddle" adjacent EEZs, or an EEZ and an adjacent high seas area, and requires the states concerned to agree (either directly or through an organization) on the measures necessary to ensure the conservation of such stocks. Article 64 requires coastal states and distant-water fishing states that harvest highly migratory stocks such as tuna to cooperate (either directly or through an organization) to ensure the conservation and optimum utilization of such stocks. Article 65 contains strong language requiring nations to "work through the appropriate international organization" to conserve, manage, and study whales and dolphins. Article 66 gives the states of origin primary responsibility for anadromous stocks (e.g., salmon and sturgeon), but requires the states of origin to cooperate with other states whose nationals have traditionally harvested such stocks and states whose waters these fish migrate through.

On the high seas, Articles 118 and 119 require states to cooperate with other states whose nationals exploit identical or associated species. Article 118 is mandatory in stating that nations "shall enter into negotiations with a view to taking the measures necessary for the conservation of the living resources concerned" (emphasis added), and suggests creating regional fisheries organizations, as appropriate. Article 120 states that the provisions of Article 65 on marine mammals also apply on the high seas.

These provisions thus reinforce the duty to cooperate that has always existed in customary international law. Because they are not specific enough to resolve conflicts that have arisen as species have been overexploited, the 1995 Straddling and Migratory Stocks Agreement was negotiated.

3. THE 1995 STRADDLING AND MIGRATORY FISH STOCKS AGREEMENT[14]

On December 4, 1995, the nations of the world settled on the text of an important document with the cumbersome title of "Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks

[14] Some of the material in this section is adapted and updated from J. M. Van Dyke. 1996. The Straddling and Migratory Stocks Agreement and the Pacific, 11 INT'L J. MARINE & COASTAL L. 406.

and Highly Migratory Fish Stocks."[15] It builds on existing provisions in the 1982 United Nations Law of the Sea Convention described above, but it also introduces a number of new strategies and obligations that have been requiring fishers to alter their operations in a number of significant ways. In addition to strengthening the role of regional organizations, as explained below, it also promotes peaceful dispute resolution by applying the dispute-resolution procedures of the Law of the Sea Convention to disputes involving straddling and migratory stocks. Ratifications of the 1995 Agreement have been steady, but many important countries have not become contracting parties. As of September 2005, 56 countries had ratified the Agreement, including most European countries, the United States, India, and Liberia, but key fishing countries like Japan, Republic of Korea, China, and most of the Latin American and African countries, and many of the countries providing flags of convenience had not yet ratified the Agreement.[16] Professor Rosemary Rayfuse has recently suggested that "even in the absence of...wider ratification, it is arguable that certain principles embodied in the [Straddling and Migratory Fish Stocks Agreement] and the [FAO] Compliance Agreement may not be binding on all states as a matter of customary international law."[17] Her primary example of a provision that has become obligatory through state practice is "the obligation to co-operate in respect of high seas fisheries through the medium of RFMOs or other co-operative arrangements."[18]

3.1 The duty to cooperate

The guiding principle that governs the 1995 Agreement is the duty to cooperate. This core concept is given specific new meaning, and the coastal nations and distant-water fishing nations of each region are now required to share data and manage the straddling fisheries together. Article 7(2) requires that "[c]onservation and management measures established for the high seas and those adopted for areas under national jurisdiction shall be compatible in order to ensure conservation and management of the straddling fish stocks and highly migratory fish stocks in their entirety" (emphasis added). This duty gives the coastal state a leadership role in determining the allowable catch to be taken from a stock that is found both within and outside its exclusive economic zone, as evidenced by the requirement in Article 7(2)(a) that contracting parties "take into account" the conservation measures established by the coastal state under Article 61 of the Law of the Sea Convention for its EEZ "and ensure that measures established in respect of such stocks for the high seas do not undermine the effectiveness of such measures." This polite diplomatic language indicates clearly that catch rates outside

[15] Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, U.N. Doc. A/CONF.164/37, 8 September 1995, 34 I.L.M. 1542 (1995). See generally J. E. Colburn. 1995. Comment, Turbot Wars: Straddling Stocks, Regime Theory, and a New U.N. Agreement, 6 J. TRANSNAT'L LAW & POLICY 323; D. M. Kedziora, Gunboat Diplomacy in the Northwest Atlantic: The 1995 Canada-EU Fishing Dispute and the United Nations Agreement on Straddling and Migratory Fish Stocks, 17 Northwestern J. of Int'l Law and Business 1132 (1996-97); M. Hayashi. 1996. The 1995 Agreement on the Conservation and Management of Straddling and Highly Migratory Fish Stocks: Significance for the Law of the Sea Convention, 29 Ocean and Coastal Management 51; M. Hayashi.1996. Enforcement by Non-Flag States on the High Seas Under the 1995 Agreement on Straddling and Highly Migratory Fish Stocks, 9 Georgetown Int'l Environmental Law Review 1; D. A. Balton. 1996. Strengthening the Law of the Sea: The New Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks, 27 Ocean Development and Int'l Law 125; J. R. Mack. 1996. Comment, International Fisheries Management: How the U.S. Conference on Straddling and Highly Migratory Fish Stocks Changes the Law of Fishing on the High Seas, 26 California Western Int'l Law J. 313; M. Christopherson. 1996. Note, Toward a Rational Harvest: The United Nations Agreement on Straddling Fish Stocks and Highly Migratory Species, 5 Minnesota J. of Global Trade 357.

[16] Website of the United Nations Law of the Sea Convention (visited Feb. 19, 2006).

[17] Rosemary Rayfuse, To Our Children's Children's Children: From Promoting to Achieving Compliance in High Seas Fisheries, 20 International Journal of Marine and Coastal Law 509, 525 (2005).

[18] Id.

a 200-nautical-mile exclusive economic zone cannot differ significantly from those within the EEZ.

3.2 The duty to work through an existing or new fisheries organization

The 1995 Agreement requires coastal and island nations to work together with distant-water fishing nations in an organization or arrangement to manage shared fisheries. Article 8(3) addresses this issue, and it is quoted in full here because its somewhat ambiguous language requires close examination:

> Where a subregional or regional fisheries management organization or arrangement has the competence to establish conservation and management measures for particular straddling fish stocks or highly migratory fish stocks, *States fishing for the stocks on the high seas and relevant coastal States shall give effect to their duty to cooperate* by becoming a member of such an organization or a participant in such an arrangement, or by agreeing to apply the conservation and management measures established by such an organization or arrangement. *States having a real interest in the fisheries concerned may become members of such organizations or participants in such arrangement. The terms of participation of such organizations or arrangements shall not preclude such States from membership or participation*; nor shall they be applied in a manner which discriminates against any State or group of States having a real interest in the fisheries concerned. (Emphasis added.)

It is hard to read this language without concluding that the coastal and island nations must cooperate with the distant-water fishing nations fishing in adjacent high seas areas either by allowing them into an existing fishery management organization or by creating a new one that all can join. All states "having a real interest" in the shared fishery stock must be allowed into the organization. Only those states that join a regional organization or agree to observe its management regulations can fish in a regional fishery (Article 8(4); and see Article 17(1)). Article 13 requires existing fisheries management organizations to "improve their effectiveness in establishing and implementing conservation and management measures..."

Article 11 addresses the difficult question whether new distant-water fishing nations must be allowed into such an organization once established. Do the nations that have established fishing activities in the region have to allow new entrants? The language of Article 11 does not give a clear answer to this question, but it seems to indicate that some new entrants could be excluded if the current fishing nations have developed a dependency on the shared fish stock in question. Furthermore, developing nations from the region would appear to have a greater right to enter the fishery than would developed nations from outside the region. "Article 25(1)(b), implies some degree of preference for developing countries that are new members, by requiring states to 'facilitate access [to high seas fisheries]...subject to articles 5 and 11."[19] The 1995 Agreement emphasizes the need to cooperate, and it requires the coastal and island nations to cooperate with the distant-water fishing nations operating in the adjacent high-seas areas to the same extent that the distant-water fishing nations must cooperate with the coastal and island nations.

3.3 The precautionary approach

The "precautionary principle" has gained almost universal acceptance during the past decade as the basic rule that should govern activities that affect the ocean environment.[20] This principle requires users of the ocean to exercise caution by undertaking relevant

[19] M. W. Lodge and S. N. Nandan. 2005. Some Suggestions Towards Better Implementation of the United Nations Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks of 1995, 20 International Journal of Marine and Coastal Law 345, 374.

[20] See generally Jon M. Van Dyke, The Evolution and International Acceptance of the Precautionary Principle, in Bringing New Law to Ocean Waters 357-79 (David D. Caron and Harry N. Scheiber eds. 2004).

research, developing non-polluting technologies, and avoiding activities that present uncertain risks to the marine ecosystem. It requires policy-makers to be alert to risks of environmental damage, and the "greater the possible harm, the more rigorous the requirements of alertness, precaution and effort."[21] It rejects the notion that the oceans have an infinite or even a measurable ability to assimilate wastes or support living resources, and it instead recognizes that our knowledge about the ocean's ecosystems may remain incomplete and that policy-makers must err on the side of protecting the environment. It certainly means at a minimum that a thorough evaluation of the environmental impacts must precede actions that may affect the marine environment. All agree that it requires a vigorous pursuit of a research agenda in order to overcome the uncertainties that exist.

Some commentators have explained the precautionary principle by emphasizing that it shifts the burden of proof: "[W]hen scientific information is in doubt, the party that wishes to develop a new project or change the existing system has the burden of demonstrating that the proposed changes will not produce unacceptable adverse impacts on existing resources and species."[22] Others have suggested that the principle has an even more dynamic element, namely that it requires all users of the ocean commons to develop alternative non-polluting or non-burdensome technologies.

The precautionary principle is given center stage as the primary basis for decision-making in the new Straddling and Migratory Stocks Agreement. Article 5(c) of the Straddling and Migratory Fish Stocks Agreement lists the "precautionary approach" among the principles that govern conservation and management of shared fish stocks, and Article 6 elaborates on this requirement in some detail, focusing on data collection and monitoring. States are required to improve their data collection, and to share their information widely with others. When "information is uncertain, unreliable or inadequate," states must be "more cautious" (Article 6 (2)) and they must take "uncertainties" into account when establishing management goals (Article 6(3)(c)). Species thought to be under stress shall be subjected to "enhanced monitoring in order to review their status and the efficacy of conservation and management measures" (Article 6(5)). If "new or exploratory fisheries" are opened, precautionary conservation measures must be established "as soon as possible" (Article 6(6)).

Then, in Annex II, the Agreement identifies a specific procedure that must be used to control exploitation and monitor the effects of the management plan. For each harvested species, a "conservation" or "limit" reference point as well as a "management" or "target" reference must be determined. If stock populations go below the agreed-upon conservation/limit reference point, then "conservation and management action should be initiated to facilitate stock recovery" (Annex II(5)). Overfished stocks must be managed to ensure that they can recover to the level at which they can produce the maximum sustainable yield (Annex II(7)). The continued use of the maximum sustainable yield approach indicates that the Agreement has not broken free from the approaches that have led to the rapid decline in the world's fisheries,[23] but the hope is that the conservation/limit reference points will lead to early warnings of trouble that will be taken more seriously.

3.4 The duty to assess and to collect and share data

Article 5(d) reaffirms the duty to "assess the impacts of fishing, other human activities and environmental factors" of stocks, and Articles 14 and 18(3)(e) explain the data

[21] David Freestone, The Precautionary Principle, in International Law and Global Climate Change 21, 36 (Robin Churchill & David Freestone eds. 1991).

[22] Freedom for the Seas in the 21st Century, supra note 1, at 477.

[23] Fishing to attain the maximum sustainable yield inevitably means reducing the abundance of a stock, sometimes by one-half or two-thirds. This reduction can threaten the stock in unforeseeable ways and also will impact on other species in the ecosystem.

collection requirements necessary to facilitate such assessments. Article 14 requires contracting parties to require fishing vessels flying their flags to collect data "in sufficient detail to facilitate effective stock assessment" (Article 14(1)(b)). Annex I then explains the specific information that must be collected, which includes the amount of fish caught by species, the amount of fish discarded, the types of fishing methods used, and the locations of the fishing vessels (Annex I, art. 3(1)). In order to permit stock assessment, each nation must also provide to the regional fishery organization data on the size, weight, length, age, and distribution of its catch, plus "other relevant research, including surveys of abundance, biomass surveys, hydro-acoustic surveys, research on environmental factors affecting stock abundance, and oceanographic and ecological studies" (Annex I, art. 3(2)). These requirements, if taken seriously, will revolutionize the fishing industry, where the competitive nature of the quest for fish has encouraged each nation to hide its activities from others to the extent possible. The data collected "must be shared with other flag States and relevant coastal States through appropriate subregional or regional fisheries management organizations or arrangements" in a "timely manner," although the "confidentiality of nonaggregated data" should be maintained (Annex I, art. 7). Decision-making at regional fishery organizations must now be "transparent" under Article 12, and international and nongovernmental organizations must be allowed to participate in meetings and to observe the basis for decisions.

3.5 The methods of enforcement

Article 18 further requires contracting parties to establish "national inspection schemes," "national observer programmes," and "vessel monitoring systems, including, as appropriate, satellite transmitter systems" to manage their flag fishing vessels with some rigor. Article 21(1) gives these requirements teeth by authorizing the ships of a nation that is party to a regional fisheries agreement to board and inspect on the high seas any ship flying the flag of any other nation that is a party to the same agreement.[24] If the boarded vessel is found to have committed a "serious violation," it can be brought into the "nearest appropriate port" for further inspection (Article 21(8)). The term "serious violation" is defined in Article 21(11) to include using prohibited fishing gear, having improper markings or identification, fishing without a license or in violation of an established quota, and failing to maintain accurate records or tampering with evidence needed for an investigation.

3.6 Dispute resolution

Part VIII of the Agreement requires contracting parties to settle their disputes peacefully, and extends the dispute-resolution mechanisms of the Law of the Sea Convention to disputes arising under this new Agreement. These procedures are complicated and somewhat untested, but should provide flexible and sophisticated mechanisms to allow nations to resolve their differences in an orderly fashion.

3.7 Recognition of the special needs of developing nations

The 1995 Agreement recognizes in Articles 24-26 that the burden of conservation may affect the coastal fisheries that many communities rely upon for subsistence. These articles state that developing states should not be required to shoulder a "disproportionate burden of the conservation action" (Art. 24(2)(c)), and they call for increased technical and financial aid to developing countries to allow them to meet their duties of data collection and dissemination.

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[24] Nations already have the power to board, inspect, and arrest vessels violating laws established to "control and manage the living resources in the exclusive economic zone." Law of the Sea Convention, supra note 8, art. 73(1).

4. THE 2000 HONOLULU CONVENTION

The Pacific Island and distant-water fishing nations with an interest in the Pacific met every six months for several years in Honolulu in the late 1990s to draft an important new treaty governing the migratory fish stocks of the Pacific Ocean. Formally called "The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean"[25] and signed in Honolulu in September 2000, this treaty creates the regional organization anticipated by Article 64 of the 1982 Law of the Sea Convention[26] and by the 1995 Straddling and Migratory Stocks Agreement.[27]

The 2000 Honolulu Convention is breathtakingly innovative in a number of significant respects. It is huge in its geographical scope, covering much of the vast Pacific Ocean and governing territorial seas and exclusive economic zones as well as high seas areas. It creates a Commission with authority to set catch limits and allocate catch quotas to fishing nations both within and outside the exclusive economic zones of coastal and island nations. The Commission can also regulate vessel types, fish size and gear, and can establish area and time limitations. Decision-making is by consensus for the central issues – such as allocation of fish to contracting parties – and by chambered voting on others, requiring a majority of support from the two chambers – one consisting of the ten distant-water-fishing nations and the other consisting of the 16 island nations – thus carefully protecting both groups. Decisions of the Commission can be reviewed by an arbitral review panel to ensure consistency and protect against discrimination.

This new treaty requires fishing of migratory species in the high seas to be compatible with the regulations that apply within adjacent exclusive economic zones. It relies on the precautionary approach as its basic foundation throughout. It reinforces the importance of the duty to cooperate. It allows Taiwan Province of China to participate in decision-making (as "Chinese Taipei"), it allows non-self-governing territories to participate (pursuant to rules to be adopted), and nongovernmental organizations can also participate in appropriate ways. Compliance will be through flag-state and port-state enforcement, boarding and inspection rights, obligatory transponders on all high-seas fisheries, and regional observers on the vessels.

The final negotiating session was held in Honolulu from August 30 to September 5, 2000, and a treaty was signed by most of the negotiating parties, but China, France and Tonga abstained[28] and Japan and Republic of Korea refused to sign the agreement.[29] The FFA members worked hard during the three-year negotiating period to ensure that the convention area was as large as possible, that decisions could be made without unanimous agreement, that developing countries would receive financial assistance to carry out their obligations under the treaty, that the treaty could come into force even if the distant-water fishing nations did not ratify it, and that a vessel monitoring system

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[25] The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean, Honolulu, Sept. 4, 2000, <http://www.spc.org.nc/coastfish/Asides/Conventions/> (26 March 2001); see generally V. Botet. 2001. Filling in One of the Last Pieces of the Ocean: Regulating Tuna in the Western and Central Pacific Ocean, 41 Virginia Journal of International Law 787-813.

[26] Law of the Sea Convention, supra note 8, art. 64; see generally J. Van Dyke and S. Heftel. 1981. Tuna Management in the Pacific: An Analysis of the South Pacific Forum Fisheries Agency, 3 University of Hawaii La Review 1, 11-17.

[27] 1995 Straddling and Migratory Stocks Agreement, supra note 11.

[28] China abstained because of its concern about Taiwan Province of China's classification as a "fishing entity," with some rights to participate separately in decision-making, and France abstained because it wanted the French islands in the Pacific to have separate status in the Commission that is to be established.

[29] Japan and Republic of Korea stated that they view the treaty as too restrictive of their historic fishing practices in the high seas. These countries have, however, been participating in some of the subsequent meetings and are expected eventually to ratify the Convention.

would become mandatory for all vessels. Although not all the FFA positions were achieved to extent desired,[30] the final version of the treaty was signed in September 2000 by all the FFA members except Tonga. Since then, the Republic of Korea, Japan and China have ratified the Honolulu Convention, along with all other countries involved in the negotiations except the United States and Indonesia,[31] and the contracting parties have been meeting regularly to establish the institutions created by the Convention and to start making the difficult decisions required to implement it. The United States is expected to ratify the Convention. President Bush recommended ratification in May 2005,[32] and the Senate Foreign Relations Committee held a hearing on it on September 29, 2005.[33] Pending ratification, the United States has attended meetings in recent months as a "cooperating non-member."

5. ALLOCATION OPTIONS

Everyone who has ventured an opinion about the challenge of allocating fish agrees that such allocations should be both "equitable" and "efficient," but giving meaning to those terms remains elusive. One typical well-meaning but vague pronouncement on this topic provides the following language:

> *Equity in the allocation of both rights and obligations.* Regimes that balance the competing interests of all participants are likely to be perceived as the most legitimate, which should in turn promote higher levels of compliance with agreed fishing rules. Among the many balances to be found are: those that have historically participated vs. new entrants; coastal States vs. distant water fishing States; developed States vs. developing States.[34]

5.1 Conservation is paramount

Michael W. Lodge and Satya N. Nandan have made the important point that "allocation rights, both in the EEZ and on the high seas, are subordinate to the obligation to conserve."[35] At the present time, they note, "neither UNFSA, nor the decision rules of many existing RFMOs, provide mechanisms for allocation that balance conservation interests with the economic and social interests of states. In fact, within many RFMOs, negotiated criteria for catch allocations are often based on the notion of historical catch, which is a powerful incentive to indulge in a race to fish."[36] And, they add, the problem of overfishing may be exacerbated by "adding developing state fishing capacity to existing overcapacity, especially where this operates simply as a mechanism to support reflagging and transfer of effort by distant water fishing nations (DWFNs)."[37]

Professor Ted L. McDorman has noted that "the setting of the total allowable catch (TAC)" and "quota allocation decisions...are inevitably the most controversial"

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[30] Among the many compromises, for instance, was the decision-making provision, which established "chambers" consisting of the FFA and the non-FFA members of the Commission, and provided that each chamber would need to support a decision by a three-fourths majority, with the proviso that no proposal could be defeated by fewer than three votes in either chamber.

[31] Status of the Convention on the Conservation and Management of Highly Migratory "Fish Stocks in the Western and Central Pacific Ocean, WCPFC/Comm.2/07 Rev. 1, available at <http://www.spc.int/OceanFish/Html/WCPFC> (visited Feb. 20, 2006).

[32] Press Release, George W. Bush, Message to the United States Senate Regarding WCPF Convention (May 16, 2005), available at http://www.whitehouse.gov/news/releases/2005/05/20050516-7.html (visited Sept. 4, 2005).

[33] 151 Cong. Rec. S D990 (daily ed. Sept. 29, 2005).

[34] See D. A. Balton and D. C. Zbicz. 2004. Managing Deep-Sea Fisheries: Some Threshold Questions, 19 International Journal of Marine and Coastal Law 247, 257.

[35] Lodge and Nandan, supra note 15, at 374.

[36] Id.

[37] Id.

for regional fishery management organizations (RFMOs).[38] He suggests looking to the considerations listed in Article 11 of the Straddling and Migratory Fish Stocks Agreement governing the participation of new members of fishery organizations for guidance regarding allocation rights within the fishery – "the status of the stocks and existing fishing efforts; existing fishing patterns (historic fishing activity); economic need and coastal state dependence; and contribution to conservation."[39] He stresses that consensus is important to ensure support for the allocation decisions, and suggest that to promote consensus "in years, and for stocks where consensus cannot be reached, that the quotas for each member decline by a pre-set amount (e.g. 20%) for each year non-consensus prevails."[40]

"Equity" is a complicated and multifaceted concept, with different applications in different contexts. It certainly includes the concept of being "fair," but just as certainly it does not inevitably mean that everyone should receive an equal amount. In the maritime boundary context, Articles 74 and 83 of the Law of the Sea Convention require opposite and adjacent states to reach an "equitable solution," language was chosen instead of phrasing that would have stated that boundaries should be drawn along the "median" or "equidistance" line separating the land areas of the countries. The concept of an "equitable solution" in the boundary context has generated a series of specific rules, as discussed below,[41] including, for instance, that the boundary that would exist if the equidistance line were utilized should be adjusted in light of the length of the coastlines of the competing countries, because the coastlines provide some rough indication of the relationship between the country and the adjacent waters.[42]

5.2 Common but differentiated rights and responsibilities

Both the Law of the Sea Convention and the Straddling and Migratory Fish Stocks Agreement contain provisions recognizing that countries have common but differentiated responsibilities and rights. These treaties recognize that the formal equality of states does not inevitably mean that all states are similarly situated, because some have better means to protect the global environment and to assist other states and some have stronger claims to shared resources than others. This idea was identified in Principle 23 of the 1972 Stockholm Declaration,[43] which explained that "it will be essential in all cases to consider ... the extent of applicability of standards which are valid for the most advanced countries but which may be inappropriate and of unwarranted social cost for developing countries." Principle 7 of the 1992 Rio Declaration[44] went on to say more directly that: "In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities." This principle of "common but differentiated responsibility" has two prominent elements – asymmetry of obligations and financial support for developing countries.

The Law of the Sea Convention recognizes these different responsibilities in several articles, including, for instance, Article 207 on land-based pollution, which refers to the economic capabilities of developing states when articulating the responsibility to

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[38] T. L. McDorman. 2005. Implementing Existing Tools: Turning Words into Actions – Decision-Making Processes of Regional Fisheries Management Organizations (RFMOs), 20 International Journal of Marine and Coastal Law 423, 425.

[39] Id. at 438.

[40] Id. at 440 (noting that the quota reductions "can be justified on the basis of precaution" and that this procedure would provide "an important incentive to agree on allocations").

[41] See infra text at notes.

[42] See e.g. J. M. Van Dyke. 1996. The Aegean Sea Dispute: Options and Avenues, 20 Marine Policy 397, 398-401.

[43] Stockholm Declaration of the Human Environment.1972. Report of the UN Conference on the Human Environment, UN Document A/CONF/48/14/Rev. 1.

[44] Rio Declaration on Environment and Development. 1992. UN Document A/CONF.151/5/Rev.1.

deal with this problem.[45] Other provisions in the Law of the Sea Convention providing special preferences for developing and otherwise disadvantaged countries include:

- Article 62(2) and (3) – granting developing countries preferential rights to the surplus stocks in the EEZs of other coastal states in their region.
- Articles 69 and 70 – giving developing landlocked and geographically disadvantaged states preferential rights to the surplus stocks in EEZs of coastal states in their region.
- Article 82 – exempting developing states from making payments from continental shelf resources beyond 200 nautical miles and have preferential rights to payments made by other states.
- Article 119 – apparently giving developing countries some preferential rights to the living resources of the high seas.
- Article 194(1) – stating states must prevent, reduce, and control pollution of the marine environment "using for this purpose the best practicable means at their disposal and *in accordance with their capabilities*" (emphasis added).
- Article 199 – requiring states to develop contingency plans for responding to pollution incidents "*in accordance with their capabilities*" (emphasis added).
- Articles 202-03 – stating that developing states are entitled to training, equipment, and financial assistance from developed states and international organizations with regard to the prevention, reduction, and control of marine pollution.
- Article 206 – explaining that the duty to assess environmental impacts of planned activities extends "*as far as practicable*" (emphasis added).
- Articles 266-69 – stating that developing countries are entitled to receive "marine science and marine technology on fair and reasonable terms and conditions."
- The 1995 Straddling and Migratory Fish Stocks Agreement[46] also contains a number of provisions recognizing the special rights of developing countries: The Preamble recognizes "the need for specific assistance, including financial, scientific and technological assistance, in order that developing States can participate effectively in the conservation, management and sustainable use of straddling fish stocks and highly migratory fish stocks..."
- Article 3(3) says that "States shall give due consideration to *the respective capacities of developing States* to apply articles 5, 6 and 7 within areas under national jurisdiction and their need for assistance as provided for in this Agreement" (emphasis added).
- Article 11(f) gives developing states a preference to enter into a fishery and into a fishery organization as a new member.
- Article 24 addresses the financial needs of developing countries:
  1. States shall give full recognition to the *special requirements of developing States* in relation to conservation and management of straddling fish stocks and highly migratory fish stocks and development of fisheries for such stocks. To this end, *States shall*, either directly or through the United Nations Development Programme, the Food and Agriculture Organization of the United Nations and other specialized agencies, the Global Environment Facility, the Commission on Sustainable Development and other appropriate international and regional organizations and bodies, *provide assistance to developing States*... (emphasis added).

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[45] Law of the Sea Convention, supra note 8, art. 207(4) (emphasis added):
States, acting especially through competent international organizations or diplomatic conference, shall endeavour to establish global and regional rules, standards and recommended practices and procedures to prevent, reduce and control pollution of the marine environment from land-based sources, *taking into account* characteristic regional features, *the economic capacity of developing States and their need for economic development*...

[46] Straddling and Migratory Fish Stocks Agreement, supra note 11.

- Article 25 provides some more specific language regarding these obligations:
  1. States shall cooperate, either directly or through subregional, regional or global organizations:
     (a) *to enhance the ability of developing States, in particular the least-developed among them and small island developing States*, to conserve and manage straddling fish stocks and highly migratory fish stocks and to develop their own fisheries for such stocks;
     (b) to assist developing States, *in particular the least-developed among them and small island developing States*, to enable them to participate in high seas fisheries for such stocks, including facilitating *access to such fisheries* subject to articles 5 and 11; and
     (c) to facilitate the participation of developing States in subregional and regional fisheries management organizations and arrangements... (Emphasis added.)
- Funding is addressed in Article 26: 1.
  1. States shall cooperate to *establish special funds to assist developing States* in the implementation of this Agreement, including assisting developing States to meet the costs involved in any proceedings for the settlement of disputes to which they may be parties.
  2. States and international organizations *should assist developing States in establishing new subregional or regional fisheries management organizations or arrangements*, or in strengthening existing organizations or arrangements, for the conservation and management of straddling fish stocks and highly migratory fish stocks. (Emphasis added.)

From these many provisions it should be clear that one element of any "equitable" approach to allocation is that developing countries must receive a share linked to their greater needs and must also receive financial assistance so that they can take proper advantage of the fish in their region.

5.3 Should allocation be based on population? Or on a state's "dependence" on fish for food security?

If the focus remains on "equity," then obviously some attention to the numbers of mouths that need to be fed is relevant to any allocation decision. Some may argue that a fish-per-capita allocation system, perhaps with some modifications for unique "equitable" considerations, makes sense and offers some elegant simplicity. Others would point out that some communities "depend" on fish or enjoy eating fish more than others, and would argue historical fishing practices should be recognized as the baseline from which allocations should be made. Still others[47] might suggest that utilizing historical fishing practices will inevitably reward the more developed countries, which have been able to finance large fishing operations, and will once again disadvantage developing countries. Basing allocations on historical fishing activities will tend to reward those countries that have overcapitalized and subsidized their fishing fleets, thus giving benefits for activities that have distorted the market and which would be punished in other economic sectors.

5.4 The importance of "contiguity" or geographical proximity

A system focused on population would allow the populated nations to come into all regions with priorities to harvest the fish, and would ignore the link between the residents of the area and the nearby fish. Any equitable system of allocation will have to recognize the importance of geographical proximity, or contiguity, to the allocation choices that must be made. Especially since regional fishery management organizations

[47] See supra text at note 32, for the quote on this topic from Lodge and Nandan.

frequently have responsibilities over fish within exclusive economic zones as well as fish on the high seas, the allocation decisions made by the organizations must recognize the "sovereign rights" that states have to the fish in their EEZs, which gives them a substantial priority in any allocation scheme. In the Pacific, the Pacific Island communities must have a priority to the fish in their region because of their geographical proximity and because they are developing nations that are entitled to assistance and priorities under both the Law of the Sea Convention and the Straddling and Migratory Fish Stocks Agreement.

5.5 What other "equitable" criteria are relevant?

Other ideas for equitable criteria to apply to allocation decisions can be gleaned from the criteria developed in maritime boundary delimitation adjudications, from criteria relevant to disputes over sovereignty of remote areas, and from the Rio Principles. In maritime boundary disputes, members of decision-making tribunals usually start with an equidistance or median line, but then adjust it to correspond to "special circumstances" and equitable considerations.[48] The factor that has been used most consistently to adjust this line has been the proportionality of the length of the coastlines of the disputing states.[49] This criterion has been preferred over candidates such as coastal population and economic activity in the coastal waters, because it is a stable factor that is unlikely to change over time. Another element of these boundary decisions that has been relatively consistent during the past four decades has been that the decisions tend to reject an "all-or-nothing" approach and to allocate each state at least some maritime space, and thus to find a solution that each country can live with. Decision makers tend to recognize that even geographically disadvantaged countries have rights to maritime resources, and as sovereign states have the right "to participate in international arrangements as an equal."[50] Maritime delimitations thus tend to recognize the vital security interests of each nation, and to craft a solution that protects these interests.[51] Food security is certainly a crucial element of any state's national security interests, and access to food sources is important to every community. The case where this interest was recognized most directly is the *Jan Mayen Case*, where Norway (which had sovereignty over Jan Mayen Island) was allocated a maritime zone sufficient to give it equitable access to the important capelin fishery that lies between Jan Mayen and Greenland.[52]

If we look at the criteria that have been applied to resolve sovereignty disputes over remote land territory, we find tribunals focusing on links between the claimants and the territory expressed through "discovery" and "effective occupation," focusing in particular on recent displays of sovereignty. "Contiguity" is sometimes discounted, but has played a role in other situations.

The judicial and arbitral decisions regarding sovereignty disputes over islands since World War II have focused more on which country has exercised actual governmental

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[48] See generally Van Dyke, Aegean Sea Dispute, supra note 38, at 398-401.

[49] This approach has been used particularly in the *Case Concerning Delimitation of the Maritime Boundary in the Gulf of Maine Area (Canada v. United States)*, 1984 I.C.J. 246, *Case Concerning the Continental Shelf (Libya v. Malta)*, 1985 I.C.J. 13, paras. 66 and 75, *Case Concerning Maritime Delimitation in the Area Between Greenland and Jan Mayen (Denmark v. Norway)*, 1993 I.C.J. 38, [hereafter cited as *Jan Mayen Case*], and the *Delimitation of the Maritime Areas Between Canada and France (St. Pierre and Miquelon)*, 31 I.L.M. 1149 (1992). See generally J. I. Charney. 1994. Progress in International Maritime Boundary Delimitation Law, 88 American Journal of International Law 227, 241–43.

[50] Charney, supra note 45, at 249.

[51] This principle was also recognized in the *Jan Mayen Case*, supra note 45, where the Court refused to allow the maritime boundary to be too close to Jan Mayen island, and it can be found in the background of all the recent decisions. The refusal of tribunals to adopt an "all-or-nothing" solution in any of these cases illustrates their sensitivity to the need to protect the vital security interests of each nation.

[52] *Jan Mayen Case*, supra note 45.

control over the feature during the previous century, than on earlier historical records.[53] The first major decision by the International Court of Justice regarding ownership of an isolated uninhabited island feature was the decision in the *Minquiers and Ecrehos Case*,[54] where the Court explained that: "What is of *decisive importance*, in the opinion of the Court, is not indirect presumptions deduced from events in the Middle Ages, but the evidence which relates directly to the possession of the Ecrehos and Minquiers groups."[55] This view was followed in the *Gulf of Fonseca Case*,[56] where the court focused on evidence of actual recent occupation and acquiescence by other countries to determine title to disputed islets, and in the decision in the *Eritrea-Yemen Arbitration*,[57] where the tribunal relied explicitly on the *Minquiers and Ecrehos* judgment for the proposition that it is the relatively recent history of use and possession of the islets that is most instructive in determining sovereignty and that the historical-title claims offered by each side were not ultimately helpful in resolving the dispute: "The modern international law of acquisition (or attribution) of territory generally requires that there be: an intentional display of power and authority over the territory, by the exercise of jurisdiction and state functions, on a continuous and peaceful basis."[58]

This very same approach was utilized by the Court in its recent decision resolving a dispute between Malaysia and Indonesia over two tiny islets – Ligitan and Sipadan.[59] The larger of the islets (Sipadan) is 0.13 square kilometres in size.[60] Neither has been inhabited historically, but both have lighthouses on them and Sipadan has recently been "developed into a tourist resort for scuba-diving."[61] The Court first addressed arguments based on earlier treaties, maps, and succession, but found that they did not establish any clear sovereignty.[62] It then looked at the "*effectivites*" – or actual examples of exercises of sovereignty over the islets, and explained that it would look at exercises of sovereignty even if they did "not co-exist with any legal title."[63] Indonesia claimed title based on various naval exercises in the area conducted by themselves and previously by their colonial power (the Netherlands), but Malaysia prevailed based on the governmental actions of its colonial power (the United Kingdom) exercising control over turtle egg collection and constructing lighthouses on both islets.[64]

Contiguity, or geographical proximity, has not always played a decisive role in adjudications, but it sometimes has been a significant factor. Arbitrator Max Huber

53 See generally M. J. Valencia, J. M. Van Dyke, and N. A. Ludwig, Sharing the Resources of the South China Sea 17-19 (1997).

54 *Minquiers and Ecrehos Case (France/United Kingdom)*, 1953 I.C.J. 47.

55 Id. at 57 (emphasis added).

56 *Land, Island and Maritime Frontier Dispute (El Salvador/Honduras; Nicaragua intervening)*, 1992 I.C.J. 351 [hereafter cited as *Gulf of Fonseca Case*].

57 *Eritrea-Yemen Arbitration*, <http://www.pca-cpa.org> (1998-99).

58 Id., 1998 Award, para. 239.

59 *Sovereignty over Pulau Ligitan and Pulau Sipadan*, 2002 I.C.J. – (Dec. 17, 2002).

60 Id. para. 14.

61 Id.

62 Id. paras. 58, 72, 80, 92, 94, 96, 114, and 124.

63 Id. para. 126 (citing *Frontier Dispute (Burkina Faso/Republic of Mali)*, 1986 I.C.J. 587 para. 63; *Territorial Dispute (Libyan Arab Jamahiriya/Chad)*, 1994 I.C.J. 38 paras. 75-76; *Land and Maritime Boundary Between Cameroon and Nigeria (Cameroon v. Nigeria; Equatorial Guinea intervening)*, 2002 I.C.J. –, para. 68).

64 Id. para. 132.

rejected contiguity as a basis for a claim of title in the *Palmas Arbitration*,[65] and a number of countries include land areas quite distant from other parts of the country. Nonetheless a land area closely linked to another land area, and utilized by residents of the adjacent area, may "belong" to that adjacent area as a matter of logic, common sense, and historical practice. Some islets are viewed as "dependent" on other islands, and some groups of islands have historically been viewed as units; in these cases it would not be logical to divide such islands between two different sovereigns. Even Arbitrator Huber acknowledged that "[a]s regards groups of islands, it is possible that a group may under certain circumstances be regarded as in law a unit, and that the fate of the principal part may involve the rest."[66] The International Court of Justice viewed, for instance, the Minquiers group as a "dependency" of the Channel islands (Jersey and Guernsey) and thus ruled that they should be subject to the same sovereign authority.[67] In the *Gulf of Fonseca Case*, the ICJ Chamber concluded that Meanguerita was an "appendage" to or "dependency" of Meanguera, and thus should be awarded to El Salvador along with its larger neighbor.[68]

The recent development of the regimes of the continental shelf and the exclusive economic zone, as well as the extension of the territorial sea from three to 12 nautical miles in the 1982 Law of the Sea Convention, are all to some extent based on a recognition of the importance of "contiguity."[69] Another clear example of a tribunal's reliance upon concepts of contiguity can be found in the 1998-99 *Eritrea-Yemen Arbitration*.[70] The tribunal awarded to Yemen the lone island of Jabal al-Tayr and the al-Zubayr group, because Yemen's activities on these barren islands were greater, and because they are located on the Yemen side of the median line between their uncontested land territories.[71] The tribunal recognized the relevance of geographical proximity or contiguity, utilizing the "presumption that any islands off one of the coasts may be thought to belong by appurtenance to that coast unless the State on the opposite coast has been able to demonstrate a clearly better title."[72] The Mohabbakahs and the Haycock Islands were thus awarded to Eritrea because they were mostly within 12 nautical miles of the Eritrean coast.

The Rio Principles[73] are another important source for ideas regarding relevant equitable principles governing the allocation challenge. Perhaps the most relevant is Principle 4, which says that "In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be

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65 *The Arbitral Award Rendered in Conformity with the Special Agreement Concluded on January 23, 1925 Between the United States of America and the Netherlands Relating to the Arbitration of Differences Respecting Sovereignty over the Island of Palmas (or Miangas)*, 2 R.I.A.A. 829 (April 4, 1928), reprinted in 22 American Journal of International Law 867, 893-94 (1928) [hereafter cited as *Palmas Arbitration*]. Palmas is an isolated island, but when one looks at a map it seems to be closer to the Philippines than Indonesia because it is 48 miles from the large Philippine island of Mindanao and the Indonesian islands it is near (it is 51 miles from Nanusa) are small and seem isolated themselves. Arbitrator Huber wrote that: "Although states have in certain circumstances maintained that islands relatively close to their shores belonged to them in virtue of their geographical situation, it is impossible to show the existence of a rule of positive international law to the effect that islands situated outside territorial waters should belong to a state from the mere fact that its territory forms the terra firma (nearest continent or island of considerable size)." Id. at 893. Any such rule, he explained, would be "wholly lacking in precision and would in its application lead to arbitrary results." Id.

66 Id., 22 American Journal of International Law at 894; 2 UNRIAA at 855.

67 *Minquiers and Ecrehos Case (France/United Kingdom)*, 1953 I.C.J. 47, 71.

68 *Gulf of Fonseca Case*, supra note 52, 1992 ICJ 351,579, para. 368.

69 See, e.g., H. Lauterpacht, Sovereignty over Submarine Areas, 27 British Year Book of International Law 428 (1950).

70 *Eritrea-Yemen Arbitration*, <http://www.pca-cpa.org> (1998-99).

71 Id., 1998 Award, paras. 509-24.

72 Id., para. 458.

73 Rio Declaration, supra note 40; see generally J. M. Van Dyke.1996. The Rio Principles and Our Responsibilities of Ocean Stewardship, 31 Ocean and Coastal Management 1.

considered in isolation from it." This confirms the point made recently by Lodge and Nandan[74] that conservation values must remain paramount in any allocation regime. The oceans and their resources are the common heritage of humankind, and public trust values must be applied to any system dividing these resources.[75]

6. HOW SHOULD STATES BE REWARDED FOR GOOD BEHAVIOUR?

Careful management of fish stocks is expensive and challenging, and countries that make financial sacrifices to monitor and maintain threatened fish stocks should receive some reward for their actions. This principle forms the basis of Article 66 of the Law of the Sea Convention, which says that "[s]tates in whose rivers anadromous stocks originate shall have the primary interest in and responsibility for such stocks." Because the spawning habitat of salmon and other anadromous species must be maintained carefully to enable them to reproduce successfully, it has been recognized that the countries that maintain their river systems to permit successful spawning should be able to reap the bounty of the salmon harvest. This principle means that even when the salmon are in the high seas, they cannot be caught without explicit permission of the country of origin. If we extrapolate from this principle, we should find ways of rewarding countries that invest in the monitoring and maintenance of fish stocks by giving them allocation bonuses.

7. SHOULD STATES BE PUNISHED FOR MISBEHAVING?

7.1 Selfish and destructive fishing practices

Another aspect of "equity" is that countries must be held accountable for taking more than their share and engaging in destructive fishing practices. The highly destructive high seas bottom trawling, for instance, is an unsustainable practice that does "major damage" to biodiversity and destroys "resources that should be available to all states."[76] Other examples of selfish and unacceptable activities include providing a flag to vessels that engage in improper fishing activities and distorting the market by subsidizing fishing vessels.

7.2 Controlling IUU fishing

Obviously, any solution to the overfishing of high seas fisheries must involve true cooperation and transparency, which must include bringing the practice of "illegal, unregulated, and unreported" (IUU) fishing under control. This effort will require revisions to the flag-of-convenience system that allows many fishing vessels to operated with limited regulation. It will also require use of modern satellite-based vessel-monitoring-system (VMS) technology, on-board independent observers, and detailed boarding and inspection programs to increase monitoring and thus permit active enforcement of regulations.[77]

7.3 Flags of convenience

The problem of IUU fishing is directly related to the extensive use of flags of convenience:

> there has to be a collective effort to deal with the related and urgent problems of IUU fishing and free riders. The problem is that, despite the advances made by the 1995 Agreement and the various measures adopted through the FAO, not all flag states are able or willing to exercise effectively their responsibilities for fishing vessels flying their flags on the high seas. Urgent action is needed to address this problem. It is a

[74] See supra text at notes 31-33.

[75] See J. M. Van Dyke, International Governance and Stewardship of the High Seas and Its Resources, in Freedom for the Seas in the 21st Century, supra note 1, at 19.

[76] Kimball, supra note 2, at 273.

[77] See Balton and Zbicz, supra note 30, at 249-50.

matter of great concern that seven out of the 11 cases before the International Tribunal for the Law of the Sea related to the activities of fishing vessels flying so-called flags of convenience, or flags or non-compliance.[78]

Numerous strategies have been proposed to deal with the flag-of-convenience conundrum, such as "co-ordinating global and regional high seas vessel registers, vessel monitoring systems, port state measures, the use of trade measures and so on," but the essential answer is that states must "take full responsibility for the activities of their nationals, regardless of the flag of the fishing vessel concerned."[79]

8. EVOLVING INTO A RIGHTS-BASED SYSTEM

The allocation decisions that will be made by regional fishery management organizations in the next few years are extremely important, because it is almost inevitable that the allocation schemes will evolve into something akin to a "rights-based" system, and that countries will view their allocation quotas as a vested property right that they are entitled to maintain in future years. Professor McDorman seemed to recognize this phenomenon, when he proposed that countries' quotas from last year be automatically cut 20% for the current year if they cannot reach a consensus on the allocation for the current year.[80] In other words, he appeared to accept the idea that last year's quota would be the starting point for any discussion about allocation for this year and coming years. Each allocation will thus have importance not just for the current year, but because it will set a baseline for future years, and states will seek to maintain and increase their allocation. States will make investments in reliance on the allocations given to them, and they will insist that they are entitled to continue fishing at the rate that they have fished in previous years.

9. SUMMARY AND CONCLUSION

The decisions made by the regional fishery management organizations allocating fish must be "equitable" and "efficient." Translating such vague terms into actionable criteria is one of the major challenges of our generation. The analysis presented above suggests that these criteria must include the following elements:

- Conservation values must be paramount and the precautionary approach must be utilized to ensure that fish stocks remain bountiful for future generations. Countries must share data regarding their fishing activities and must support scientific research to understand the life cycle of each species and its relationships with other species in its ecosystem.
- Developing countries must be given priorities in the allocation of stocks and must be given assistance so that they can utilize their allocations effectively.
- Geographical proximity to the fish stocks must be recognized as an important element of any allocation scheme. When the stocks straddle EEZs of states, those states have a particularly strong claim to a substantial share of the allocation quota, but even for stocks outside the EEZ, the countries in the region should have a priority over those outside the region.
- Countries that make expenditures to monitor and maintain the fish stocks should be rewarded with enhanced allocations.
- Those countries that misbehave by abusing the flag-of-convenience system, by permitting IUU fishing, by allowing their vessels to engage in destructive high-seas bottom trawling, and by subsidizing their fishing industry should be punished by having their allocations reduced.

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[78] M. W. Lodge. 2004. Improving International Governance in the Deep Sea, 19 International Journal of Marine and Coastal Law 299, 307.

[79] Id. at 308.

[80] McDorman, supra note 34, at 440.

- The population of a country, its historical dependence on the fisheries in question, and its historical consumption of sea food and need for it as "food security" are also relevant considerations, although of less importance than those listed above.

Decisions must, of course, be made through a transparent process, and by consensus whenever possible. The process of allocation will be one of trial-and-error in the early years, and, because we still know so little about many species and many ocean area, precaution must always guide the allocations.

International allocation issues and the high seas: An economist's perspective

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1. INTRODUCTION

This paper is concerned with allocation issues pertaining to fishery resources that are shared internationally. My instructions are to approach the topic from the perspective of an economist. While I shall comment on the legal framework provided by the 1982 UN Convention on the Law of the Sea (UN, 1982) and the 1995 UN Fish Stocks Agreement (UN, 1995)[81], I shall, in keeping with my instructions, rely upon my colleague, Professor Jon Van Dyke, who will precede me in the panel, to review in detail the legal framework surrounding the topic.

In taking the economist's perspective, a key question that I shall attempt to address in this paper, is whether there exist approaches to allocations between and among the States/entities sharing the fishery resources that will ensure the long run sustainability of the fisheries, which the resources support. The answer would seem to be self-evident. If it is possible to identify allocation schemes that are perceived as being fair and equitable, by all those sharing the resources, then all should be well.

While not denying the importance of allocations that are seen to be fair and equitable, it will be argued that the existence of equitable allocation schemes constitutes a necessary, but not sufficient, condition for the long term sustainability of internationally shared fishery resources. This is particularly true in the case of internationally shared fishery resources that are to be found in all, or in part, in the high seas.

In attempting to address this, and related questions, I shall draw heavily upon the results of and papers presented at, the Expert Consultation on the Management of Shared Fish Stocks, mounted jointly by the government of Norway and the FAO in Bergen, in October 2002.[82] This Expert Consultation, which we shall refer to hereafter as the Bergen Expert Consultation, established several working groups, one of which dealt explicitly with the resolution of allocation issues (FAO, 2002). I should also note, in passing, that two states, which were very active in the Bergen Expert Consultation, were Australia and New Zealand.

I had the privilege of being involved in the Bergen Expert Consultation, both during the preparation phase as a consultant for the FAO, and during the Expert Consultation itself, as a participant. Following the Bergen Expert Consultation, I co-authored a

[81] The full title of the Agreement is Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks.

[82] Norway-FAO Expert Consultation on the Management of Shared Fish Stocks Bergen, Norway, 7-10 October 2002.

FAO Fisheries Technical Paper No. 465 on the conservation and management of shared fishery resources, with two colleagues from the FAO, Ms Annick Van Houtte, from the FAO Legal Office, and Mr Rolf Willmann, from the Fishery Policy and Planning Division, FAO Department of Fisheries (Munro, Van Houtte and Willmann, 2004). Needless to say, I shall draw heavily upon the Munro, Van Houtte and Willmann paper, as well.

In my attempt to address the aforementioned questions, I shall, of course, point to several real world examples, but I shall, by and in the large, touch only lightly upon cases directly involving Australia and New Zealand. My colleague, Professor Rosemary Rayfuse, who will follow me in the panel, will wish to discuss such cases in detail.

2. CLASSES OF INTERNATIONALLY SHARED FISHERY RESOURCES AND LEVELS OF COOPERATIVE RESOURCE MANAGEMENT

According to FAO estimates, internationally shared fishery resources account for as much as one third of world marine capture fishery harvests (Munro, Van Houtte and Willmann, 2004). It is thus, for good reason, that the FAO has declared that the effective management of these resources stands as one of the great challenges on the way towards achieving long-term sustainable fisheries (FAO 2002).

The FAO categorizes internationally shared fishery resources as follows:

1. Transboundary fish stocks – fishery resources that cross the EEZ boundary of one coastal State into the EEZ(s) of one, or more, neighbouring coastal States.
2. Highly migratory fish stocks – highly migratory species, as set forth in Annex 1 of the 1982 UN Convention (UN, 1982), consisting primarily of the major tuna species. In light of their highly migratory nature, they are to be found both within the coastal State EEZ and the adjacent high seas. In the adjacent high seas the stocks are subject to exploitation by distant water fishing States (DWFSs).
3. Straddling fish stocks – all other fish stocks (with the exception of anadromous/catadromous stocks) that are to be found both within the coastal State EEZ and in the adjacent high seas, where they are subject to exploitation by DWFSs.
4. Discrete high seas fish stocks – fish stocks to be found wholly within the high seas (Munro, Van Houtte and Willmann, 2004).

From an economic standpoint, there is no meaningful distinction between categories 2 and 3 (Munro *et al.*, 2004). Hence, we shall merge 2 and 3 into one category, straddling stocks, broadly defined. Consequently, we are left with: A: Transboundary stocks; B: Straddling stocks (broadly defined); C: Discrete High Seas stocks.

Two passing comments are in order. The first is that Categories A and B are far from being mutually exclusive. There are numerous fish stocks that fall into both categories, the tuna stocks of the Western and Central Pacific being a prominent example. The second comment is that Categories A, B and C are in ascending order, in terms of difficulties to be encountered in achieving effective, sustainable management of the resources.

With respect to management, we shall conclude that, with a few exceptions, all shared fish stocks, regardless of the category into which they may fall, require that States/entities act cooperatively, if the fisheries, which they support, are to be sustainable through time. The Bergen Expert Consultation was reminded that the late John Gulland had, some 20 years earlier, pointed out that there are two levels of such cooperation, the primary level, consisting of scientific cooperation alone, without reference to coordinated management programs, and the secondary level – "active management" – which, almost by definition, requires the establishment of coordinated joint management programs (Munro *et al.*, 2004). The Bergen Expert Consultation concluded that, while the primary level is useful as a precursor to the secondary level, it is seldom sufficient in of and by itself. Cooperation must, with few exceptions, move forward to the secondary level (FAO, 2002).

John Gulland went on to say that the secondary level of cooperation – "active management" – if it is to succeed, requires that the cooperating States/entities deal effectively with the following:

a. allocation of harvest shares among the participating states (or entities);
b. determination of an optimal management strategy through time, including inter alia, the determination of optimal global harvests over time; and
c. implementation and enforcement of coordinated management agreements (cited in Munro *et al.*, 2004).

The implications of the Gulland requirements are straightforward. The allocation issue is indeed a key issue that must be addressed, if cooperative resource management is to succeed. The issue cannot be addressed in isolation, however. Simultaneously, one must address the issues of determining the optimal resource management strategies through time, and of implementing and enforcing the coordinated resource management agreements.

3. TRANSBOUNDARY FISH STOCKS

We commence with the case of Category A fish stocks – transboundary stocks, those crossing the EEZ boundary into the EEZ(s) of one, or more, neighbouring coastal States. We do so for two interrelated reasons. First, the problems to be faced in achieving effective resource management are less formidable than they are in case of Categories B and C stocks. Secondly, transboundary fish stocks were recognized as a major resource management issue well before the other two categories were so recognized. As a consequence, the management of transboundary fish stocks has been extensively studied by economists, legal experts, as well as other. With respect to the economic aspects of management, the economics of the management of transboundary stocks has come to serve as the foundation for the economics of the management of straddling and discrete high seas fish stocks.

The first question to be raised is: what, in fact, is to be allocated between, or among, the coastal States sharing the resource? Is it the agreed upon TAC (or its equivalent) that is to be allocated among the separate coastal States fleets, or is it the net economic benefits that arise from the total harvests (resource rent, to use some economic jargon) that is to be allocated.

The two are not necessarily the same. At a later point in the discussion, reference will be made to a particularly successful cooperative fisheries management arrangement, involving four States, in which the national fleets of two out of the four were allocated annual harvest shares of zero. We shall maintain that, if the sharing of the net economic benefits from the relevant fishery(ies) is to be done only through the sharing of harvests among national fleets, bargaining among the coastal States will be constrained, with consequences that could be severe.

Next, let me comment on the underlying legal framework surrounding the management of these resources, to be found in 1982 UN Convention. While I defer to my colleagues on the panel for a detailed analysis of the framework, I allow myself the following remarks. The 1982 UN Convention contains but one article pertaining to the management of these stocks, namely Article 63(1). The article imposes a duty on relevant coastal States to negotiate over arrangements for the management of these resources. What the article does not do is to impose a duty on the coastal States to reach an agreement. If the States negotiate in good faith, but are unable to reach an agreement, then each State is to manage its share of the resource (i.e. that part occurring within its EEZ), in accordance with the relevant rights and duties laid down by the 1982 UN Convention (Van Houtte, 2003). We can refer to this as the default option.

With the default option in mind, economists find that they have before them two issues, which they must attempt to analyse:

1. The consequences, if any, of the relevant coastal States adopting the default option, and not cooperating in the management of the resource, at least not beyond the primary level of coordinating scientific research.
2. The conditions that must prevail, if a cooperative management regime (at the secondary level) is to be stable over the long run.

If, in investigating the first issue, it is found that non-cooperative management does not carry with it significant negative consequences, then, of course, the second issue ceases to be of interest, and can be safely ignored. It will also mean, needless to say, that we shall have no allocation issues worthy of the name. Examples of shared fish stocks can be found, in which we shall reach just such a conclusion, with respect to the first issue.

If it is discovered that non-cooperation does, in fact, yield results much inferior to cooperation, then the second issue must be addressed head-on. The investigation of the second issue – the conditions that must be met, if cooperative resource management regimes are to be stable through time – will have to take place in the knowledge that any cooperative resource management arrangement must be, as Scott Barrett emphasizes in his recent book Environment and Statecraft, self-enforcing (Barrett 2003).

By the term self-enforcing, Barrett means that no participant in an arrangement, or agreement, can turn to a third party to enforce the arrangement/agreement. Those entering into a domestic contract, he points out, can turn to the courts, local or national, to enforce the contract, should a dispute arise. The ICJ notwithstanding, States entering into an international treaty arrangement, or some other form of contractual international agreement, have no such recourse. Hence, the arrangement/agreement must be self-enforcing, and so it is with cooperative fisheries management arrangements (Barrett 2003).[83]

Consider now the simplest case of a transboundary resource, one that is shared by two neighbouring coastal States. Take as an example the one provided by a rich scallop resource off the Atlantic coast of North America, shared by the United States and Canada. With the advent of Extended Fisheries Jurisdiction, and the resolution of the Atlantic coastal zone boundary delimitation dispute between the two coastal States, it was found, for various biological, seabed terrain and technological reasons, that the harvesting of scallops in the Canadian zone had no significant impact upon American harvesting opportunities, and vice-versa. The default option provided by the 1982 UN Convention, while perhaps not perfect, was deemed to be adequate. There was no strong case to be made for secondary level cooperation (Munro, 1987).

The case of the Atlantic scallop fishery resource, shared by the United States and Canada, is the exception, not the rule. The usual, the normal, situation is one in which the harvesting activity of one coastal State, sharing a fishery resource, will have a significant impact upon the harvesting opportunities of its neighbours. Thus, a strategic interaction will inevitably arise between the two States. The resource management decisions made by the first coastal State will influence the resource management decisions of the second coastal State. The reverse will be equally true.

If, in what we have termed the standard, or normal, transboundary fish stock case, there will inevitably be strategic interaction between or among, the coastal States sharing the resources, then economists have no choice, but to incorporate such strategic interaction into their analysis. The economics of the management of transboundary fish stocks is, as a consequence, a blend of the standard fisheries economic applied to single state fisheries, and the theory of strategic interaction (or interactive decision theory), more commonly known as the theory of games.[84] Economists studying other

[83] Most of Scott Barrett's book is devoted to the problems of international pollution. Nonetheless, his analysis does have direct relevance to international fisheries.

[84] The name comes from the fact that games, e.g. card games, were often used to illustrate the theory. In some ways, the name is unfortunate, in that it creates the impression that the theory is confined to frivolous issues, which it most definitely is not.

shared resources, e.g. water resources, the atmosphere, also find themselves compelled to incorporate game theory into their analysis.

Game theory is becoming increasingly widely used in many different branches of economics, as well as being used in numerous other fields, such as legal studies, international relations and evolutionary biology. As an indication of the growing importance of game theory, the Nobel Prize in Economic Sciences has now been awarded twice to specialists in game theory. The first was a joint award in 1994, with one of the recipients being John Nash, who laid the foundation for much of the game theory used in economics. The second, also a joint award, was given in 2005. The press release announcing the awarding of the Prize for 2005 to Laureates Thomas Schelling and Robert Aumann, read as follows:

> Why do some groups of individuals, organizations and countries succeed in promoting cooperation while others suffer from conflict? The work of Robert Aumann and Thomas Schelling has established game theory – or interactive decision theory – as the dominant approach to this age-old question. (Nobelprize.org, 2005.)

For the purposes of this paper, we need only a broad overview of game theory – theory of strategic interaction – and the insights which the theory can offer us, when dealing with the two central issues before us.[85] We do, nonetheless, require some basic terminology.

To begin, those engaging in the strategic interaction, e.g. coastal States sharing a transboundary fishery resource, are referred to as "players. The "players" are assumed to be rational and to have various courses of action open to them, which are referred to as "strategies." The expected return to a player, in following a particular strategy, is then referred to as a "payoff." The size of the expected return or "payoff" will, needless to say, be dependent upon the known, or expected, reactions of other "players." The interaction between, or among, the players, as they execute their strategies, is the game. The stable outcome of a game, if it exists, is termed the "solution" to the game. Finally, the game may be a "once only" affair, or it may be repeated.

There are two broad categories of games, these being competitive, or non-cooperative, games, and cooperative games. In a cooperative game, the players are assumed to be motivated entirely by self interest, but have some incentive to attempt to cooperate. Of critical importance is the fact that players are able to communicate with one another effectively. In competitive, non-cooperative games, the lines of communication between and among the players are, more often than not, faulty, or are simply non-existent.

Having said all of this, however, it must be emphasized in passing that open lines of communication, between and among players, do not, in of and by themselves, guarantee a stable solution to a cooperative game. As we shall emphasize, communication among players is a necessary, but not sufficient, condition for a stable outcome (solution) to the cooperative game.

In exploring the first issue – the consequences of non-cooperative resource management – we draw, not surprisingly, upon the theory of non-cooperative games. The key conclusion arising from non-cooperative game theory is that the "players" will be driven inexorably to adopt strategies that they know perfectly well will produce decidedly undesirable results. This outcome is referred to as a "Prisoner's Dilemma" outcome after a famous non-cooperative game developed to illustrate the point (Tucker, 1950). The "Prisoner's Dilemma," and its application to fisheries, is discussed in an accompanying technical appendix, Appendix A.

[85] Having said this, we include two technical appendices, which go into the nature of game theory, and its application to international fisheries, in greater depth.

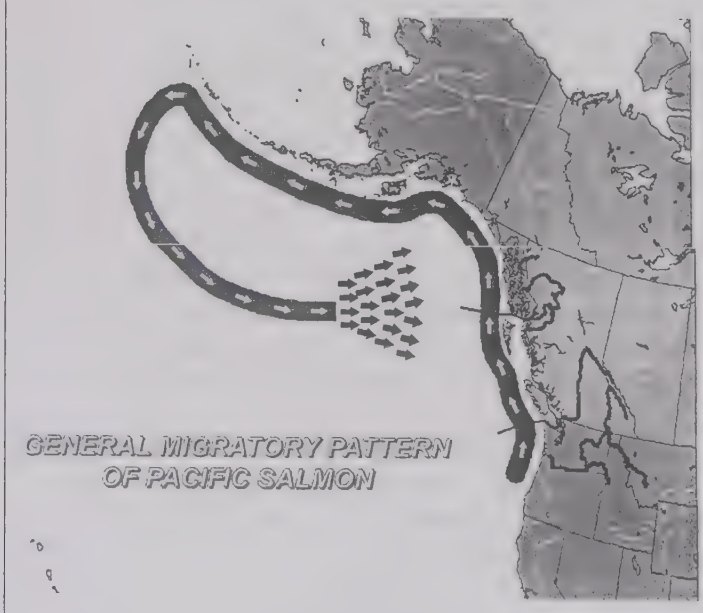
The basic nature of the "Prisoner's Dilemma" outcome, in a fisheries context, can be illustrated as follows. Consider a transboundary fishery resource shared by two coastal States A and B. A's harvesting activities will have an impact upon B, and vice versa. Suppose further that there is no significant resource management cooperation between the two. A and B adopt the default option and manage their respective segments of the resource on their own.

If A undertakes to restrict harvests in order to "invest" in the resource, the benefits from this action will not be enjoyed by A alone, but will be shared with B. What assurance does A have that B will also undertake to conserve the resource? Since there is no cooperation, the answer is none. It is only too possible that B would be content to "free ride" off of A's resource investment efforts. In these circumstances, it is likely that A will conclude that the return on its resource investment would be less than the cost, and that its best course of action ("strategy") is to do nothing. B could be expected to come to the same conclusion.

Worse, A has to allow for the possibility that B might deliberately deplete the resource. If A seriously believes this, then it could decide that its best strategy is to strike first. Once again, B could follow the same line of reasoning.

For a real world example, we turn to one of the most complex cooperative fishery management arrangements in the world, namely Pacific salmon shared by the United States and Canada. Historically, Pacific salmon was the single most important fishery resource for the fishing industries of the American states of Washington, Oregon and Alaska, and the Canadian province of British Columbia. The resource is shared, because American fishermen inevitably intercept (i.e. harvest) salmon produced in Canadian rivers and streams, while Canadian fishermen inevitably intercept American produced salmon (Figure 1).

FIGURE 1
General migratory pattern of pacific salmon



Source: Munro, McDorman and McKelvey, 1998.

The United States and Canada, two developed coastal States with extensive fisheries management resources and experience, came together in the late 1960s to cooperate in the management of all Pacific salmon fishery resources from northern California to the Gulf of Alaska.[86] The negotiations were long, arduous and difficult. A successful conclusion was not reached until 1985. What drove the negotiators on was the manifestation of the "Prisoner's Dilemma."

It was believed, at the time, that salmon production could be increased substantially through enhancement projects (e.g. fish ladders) on major salmon rivers, such as the Fraser River, which empties south of Vancouver,

[86] Canada and the United States did have a treaty for the cooperative management of Pacific salmon produced in Canada's Fraser River system, dating back to the 1930s. In the late 1960s, with the UN Third Conference on the Law of the Sea looming on the horizon, it was decided that the scope for Canada-United States cooperative management of Pacific salmon had to be broadened (Munro, McDorman and McKelvey, 1998).

British Columbia, and the Columbia River, which marks the boundary between the states of Washington and Oregon. If Canada and the United States both engaged in such projects, the mutual benefits could have been impressive. Each country deliberately held back from enhancement projects, however, for fear that the other would "free ride" on its efforts (Munro, McDorman and McKelvey, 1998).

In addition, there were outbreaks between the two countries of Pacific salmon "fish wars," which the American legal expert, Thomas Jensen, defines as deliberate overexploitation of the fishery resource for the purpose of denying harvest opportunity to the other party or parties (player or players) (Jensen, 1986, p.18). When negotiations finally reached a successful conclusion in 1985, in the form of the Canada-United States Pacific Salmon Treaty, Jensen commented that the Treaty could best be described as a "peace treaty memorializing the end of the Pacific salmon war" (Jensen, 1986, p.372). In the early 1990s, the Treaty seized up for a period of several years. During this period of treaty paralysis, the "Prisoner's Dilemma" re-emerged with a vengeance (Miller, Munro, McDorman, McKelvey and Tydemers, 2001).

It is, admittedly, possible that coastal States sharing a fishery resource will be fortunate in that, in the absence of formal cooperative resource management arrangements, tacit cooperation will emerge. Tacit cooperation is, however, inherently fragile. This author was a part of a team carrying out an economic study for the Benguela Current Large Marine Ecosystem Programme on the advisability of moving forward to a formal cooperative resource management regime for the three coastal States involved: South Africa, Namibia and Angola (Sumaila, Munro and Keith, 2005). The three States share several fishery resources, the most important of which is hake (Figure 2).

Formal fisheries management cooperation among the three has not advanced beyond the primary level. There is, to this point, no evidence of destructive fisheries practices, no evidence of the "Prisoner's Dilemma" at work. Thus, there appears to be tacit secondary level cooperative management. While not down playing the costs of establishing a formal secondary level cooperative resource management regime, we urged that the three move towards such a cooperative resource management regime. A key argument, which we made for such a move, rested upon the inherent fragility of tacit cooperation[87] (Sumaila *et al.*, ibid.)

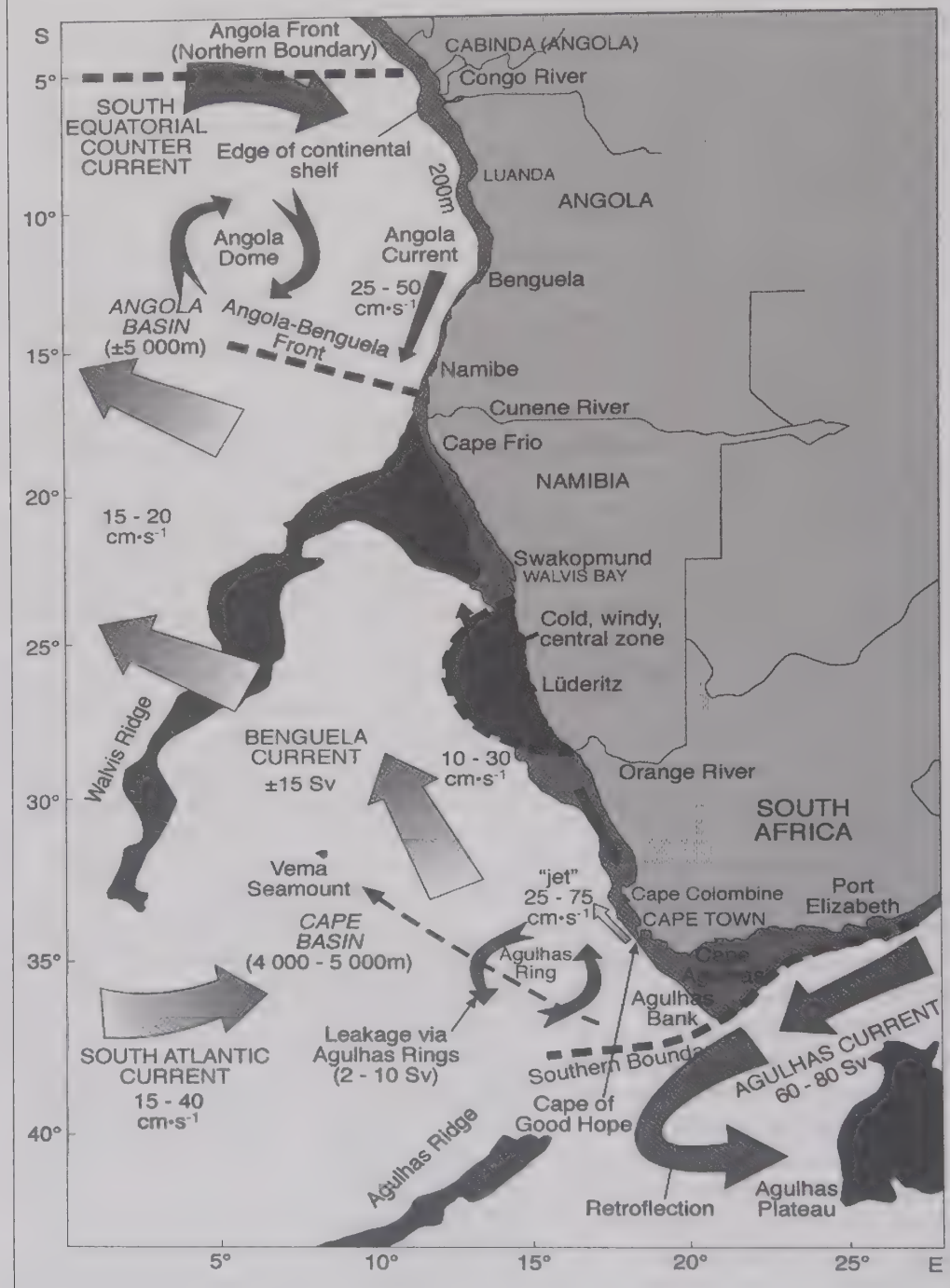
Thus, with few exceptions, cooperation (beyond the primary level) does matter in the management of transboundary stocks. Hence, we have no choice but to examine in detail, the second issue, the conditions that must be met, if the cooperative resource management arrangement is to prove to be stable through time, given that the arrangement must be self-enforcing.

In examining this issue, we draw appropriately upon the second branch of game theory, the theory of cooperative games, which is essentially a theory of bargaining. From the theory arises the first, and one might say, critical, condition for stability, a condition, which on the face of it, is stunningly obvious. It goes under the heading of the "individual rationality" condition. No cooperative arrangement will be stable unless each, and every, "player" is assured a return (payoff) from the cooperative arrangement, at least as great as that which it would enjoy by refusing to cooperate. The Report of the Bergen Expert Consultation noted that, while this proposition should be obvious, it is often ignored in practice (FAO 2002).

An accompanying, one might say overarching, condition for stability is that of perceived fairness and equity. If only one player believes that its share of the overall

[87] There had previously been uncertainty about the extent to which the resources had been shared, which caused the authors of the report to suspect that the tacit cooperation might have been inadvertent, i.e. the impact of one State's harvesting activities upon its neighbours might not have been fully recognized.

FIGURE 2
The Benguela Current Large Marine Ecosystem



Source: Sumaila, Munro and Keith 2005.

economic returns from the cooperative arrangement is inequitable, the arrangement will be inherently unstable.[88]

[88] Fairness and "individual rationality" are not entirely independent. If one player realizes that the payoff to it from cooperation is less than what it would receive from non-cooperation, it will hardly deem the cooperative arrangement to be "fair."
Historically, a "fair" basis for making allocations in the cooperative management of transboundary stocks has been seen to consist primarily of the zonal attachment of the stock, or stocks, and/or historical catch records of the relevant coastal State fleets, within their respective EEZs (see: FAO, 2002).

The problem then is to devise a cooperative arrangement, which is deemed to be fair, and which will deter defection. A cooperative arrangement, in which no participant has an incentive to defect is, by definition, self-enforcing.

Obviously, in order to achieve this goal, the allocation of the economic returns from the cooperatively managed fishery among the participants must be seen as equitable, but there is more to it than this. Return to the Gulland list of three problems that a cooperative regime must address. In addition to allocations, he included implementation and enforcement, and the determination of the optimal resource management program through time.

Consider first implementation and enforcement. If weak monitoring promises that cheating will go largely undetected, then even players with a strong moral sense, may calculate that cheating by other players will reduce their expected payoffs from cooperation below what they could expect to receive under cooperation, regardless of how "fair" their promised allocations may have been. They can be expected to refuse to cooperate – the "individual rationality" condition once again.[89]

With regards to determining the optimal resource management program through time, cooperative game theory uses the term "cooperative surplus." This refers to the difference between the sum of payoffs to the players under cooperation and the sum of the payoffs to the players under non-cooperation. Achieving optimal resource management through time will maximize the "cooperative surplus." The larger the "cooperative surplus," the more the players have to lose through a collapse of the cooperative management arrangement, and the easier it is to ensure that the "individual rationality" condition is met for each "player".

For an example, we turn to the case of a particularly successful cooperative fisheries management arrangement, which involved the cooperative management of cod, haddock and capelin in the Barents Sea, by Norway and the Soviet Union/Russia. The cooperative resource management arrangement was established in the mid-1970s, when the Cold War was in full sway. The arrangement has been successful, in spite of complications arising from the fact that some of its stocks are straddling, as well as transboundary, in nature. The arrangement has also survived the political transformation in the former Soviet Union. This author will assert that a key factor in the success of the arrangement was, and is, the magnitude of the "cooperative surplus."

Two Norwegian economists, Claire Armstrong and Ola Fläten, undertook an empirical analysis of the Barents Sea cooperative fisheries management arrangement, focusing on the most important of the three resources, cod. They argued that the cooperative arrangement was far from perfect in terms of maximizing the global economic returns from the fisheries. Nonetheless, the two estimated that the combined economic returns from the cod fishery to the two coastal States under cooperation was more than 50 times greater than what it would have been under non-cooperation (Armstrong and Fläten, 1991). While the study was completed over a decade ago, there is no reason to believe that the returns from cooperation have diminished significantly (Stokke, 2003). Thus both "players" have a great deal to lose from the cooperative management arrangement's collapse. The arrangement is indeed self-enforcing.

One complication that can arise, in attempting to achieve an optimal management regime, is that there is no guarantee that the players in the cooperative fisheries game will have identical resource management goals. This fact was recognized by the FAO, while the UN Third Conference on the Law of the Sea was under way (FAO, 1979).[90] It has been argued that, where there are differences in management goals, it is invariably

[89] See the Report on the Bergen Expert Consultation for a detailed discussion on monitoring and enforcement in cooperative fisheries management arrangements (FAO, 2002).

[90] The 1979 FAO report pointed out that one State might opt for a MSY policy, while its partner State might opt for a biomass larger than that associated with MSY, and be pleased to accept lower catch rates.

the case that one player (or players) places a higher value on the resource than the other (Munro, 1987). Maximizing the economic returns of the fishery through time obviously calls for the management preference of the player(s) placing the highest value on the resource to predominate. This outcome is unlikely to be achieved, however, if allocations among the players are to be confined to allocations of the TAC(s) among national fleets. In order for what we might call the optimum optimorum to be achieved, the player(s) placing the highest value on the resource will have to be prepared to compensate the other players through transfers, which may be monetary, but which can also take many other forms. This has come to be known as the Compensation Principle (Caddy, 1997; Munro, 1987; Munro *et al.*, 2004).

In game theory parlance, these transfers are referred to as "side payments." The use of such side payments came up for considerable discussion in the Bergen Expert Consultation, where several participants preferred the less provocative term of "negotiation facilitators" (FAO, 2002). An obvious objection to the use of side payments (negotiation facilitators) is that those called to make them will balk at the sacrifice imposed upon them. A second technical appendix, Appendix B, shows that those making the side-payments, as well as those receiving them, can expect to benefit. The use of side payments allows for a superior resource management regime to the benefit of all.

For an example of the use of side payments to the benefit of all, we turn to the case of the North Pacific fur seal fishery. From the late 19th century onwards, the fishery was shared by four states: Canada, Japan, Russia and the United States. When the fishery became significant in the late 19th century, there was no cooperative management. The "Prisoner's Dilemma" played itself out, and the resource was subject to severe overexploitation. Fearing the outright collapse of the resource, the four states came together and transformed the non-cooperative game into a cooperative one, which took the form of the 1911 Convention for the Preservation and Protection of Fur Seals, which was to last, with one lengthy hiatus, until 1984 (Barrett, 2003).

The four players were not identical. Two, Russia and the United States, were low cost harvesters, harvesting the seals on land (Pribiloff Islands), while the other two, Canada and Japan, were high cost harvesters, harvesting the seals at sea. Moreover, Russia and the United States received higher prices for their seal skins than did the other two countries. Needless to say, Russia and the United States placed a higher value on the resource than did the other two. Under the terms of the Convention, Canada and Japan were each to receive a certain fixed percentage of the TAC. The allocation to the Canadian and the Japanese fleets, however, equalled zero. All harvesting was to be done by Americans and Russians, with the Canadians and Japanese receiving their shares of the TAC in the form of seal skins, each season. The United States and Russia did, of course, determine the resource management regime.

This pure side payments cooperative arrangement proved to be profitable for all four players. Moreover, it also had beneficial conservation consequences. It was estimated that, between 1911 and 1941 (when the hiatus in the Convention, referred to earlier, commenced), the seal herds had increased eighteenfold (FAO, 1992).

A further complication arises from the number of players. As a general rule, the larger the number of "players," the more difficult it is to achieve a stable cooperative resource management regime – the curse of large numbers. The reasons are reasonably straightforward. The larger the number of "players", the greater becomes the enforcement problem, and the greater becomes the problem of reconciling conflicting management goals.[91]

[91] Confirmation has been provided by a recent empirical study on world fisheries carried out by a New Zealand economist (McWhinnie, 2005). The empirical study reveals that shared fishery resources are more likely to be subject to overexploitation than are fishery resources confined to a single EEZ. Among shared fishery resources, the risk of overexploitation increases with the number of states/entities sharing the resources.

To return to the Barents Sea example, it can be argued that another factor leading to the success of the cooperative management arrangement is that the number of coastal States involved is only two.

Even if enforcement is strong, and a good attempt to maximize the "cooperative surplus" has been made, there remains an additional condition that must be met, if the cooperative resource management regime is to be stable through time. We shall refer to this condition, or requirement, simply as "resilience."

It can be anticipated that the cooperative resource management regime will be subject to unpredictable shocks through time, due to environmental, economic or political factors. The consequence can be that, what was initially seen as a stable cooperative management regime will cease to be so, unless the cooperative resource management regime has sufficient flexibility to adjust to the shocks.

For an example, we return to the case of the Canada-United States Pacific Salmon Treaty. In the cooperative fisheries game that is the Treaty, it is reasonable to regard Canada as a single player, because, within Canada, jurisdiction over marine fisheries rests wholly with the federal government. In the United States, on the other hand, significant power rests with the individual states. The United States was, and is, therefore, not a single player, but what can be seen as a four player coalition, consisting of Washington plus Oregon, Alaska, the United States federal government, and because of key United States federal court decisions regarding the allocation of salmon harvests off of Washington/Oregon, the 24 Treaty Native American tribes of Washington, Oregon and Idaho.[92]The cooperative game is a two stage one, in which the players in the American coalition bargain among themselves, and, upon achieving a consensus, proceed to bargain with Canada.

The Alaskans have always had the least to gain form the Treaty, and indeed the Treaty negotiations temporarily ground to a halt in the early 1980s, because of Alaskan dissatisfaction. Through a complex bargaining process, the problem was resolved and the Treaty came in to place in 1985.

At the time of the signing of the Treaty there was a rough balance between Canadian interception of American produced salmon, and the American interception of Canadian produced salmon. It was recognized by all that the cooperative surplus was substantial, and it appeared that the allocation of the economic benefits from the fishery were more or less fair (Munro, McDorman and McKelvey, 1998).

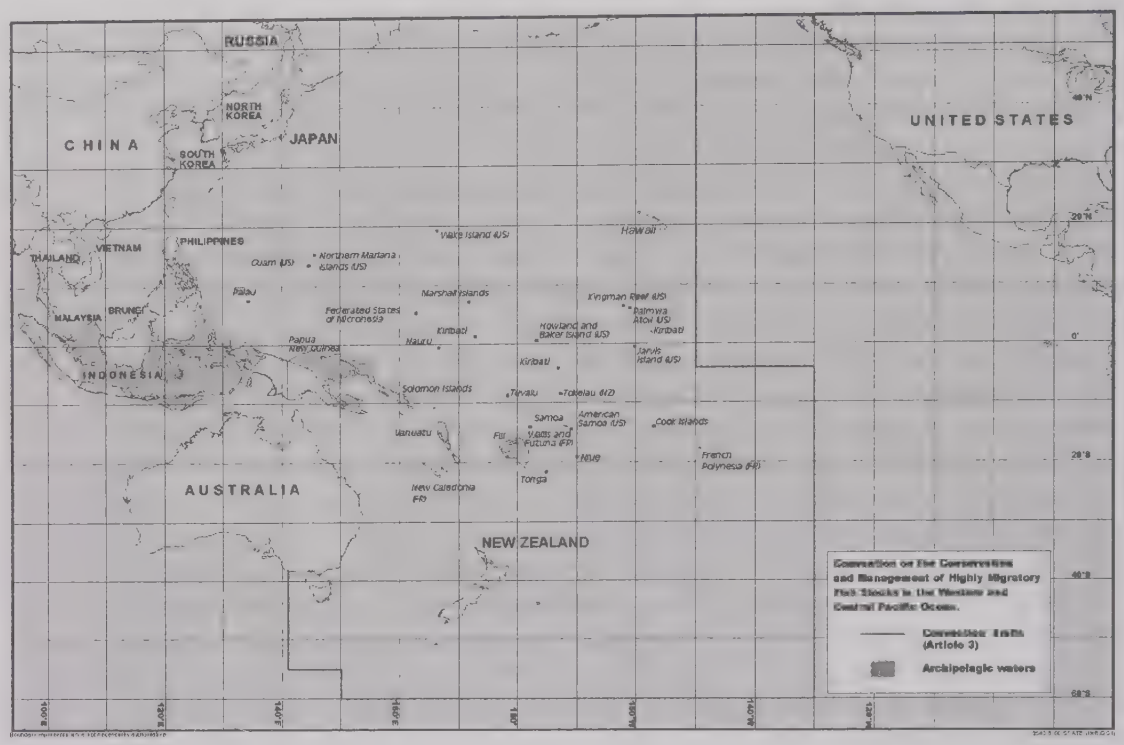
What was not recognized at the time was that there was a climate regime shift under way. The regime shift was to have a decidedly negative impact upon salmon stocks off Washington, Oregon and southern British Columbia, and a decidedly positive impact upon salmon stocks off of Alaska. The equitable division of benefits was upset, and the Treaty was thrown into disarray, with Alaska effectively being pitted against Canada, Washington/Oregon and the American Treaty tribes. To all intents and purposes the "individual rationality" condition, with respect to Alaska, was not being met (Miller *et al.*, 2001; Miller and Munro 2004).

The cooperative resource management arrangement proved to lack the resilience to withstand the major environmental shock in the form of the climate regime shift. One weakness of the Treaty was that bargaining between Canada and the American coalition was constrained by the fact there was no allowance whatsoever for side payments (Miller *et al.*, 2001).

After almost six years of treaty paralysis, Canada and the United States signed the Pacific Salmon Agreement in 1999 (United States Department of State, 1999) designed to "patch up" the Treaty. Interestingly, the Agreement contains (modest) provisions for side payments, although they are certainly not labelled as such (Miller *et al.*, 2001). At

[92] The American federal government plays a relatively minor role in the American coalition (see: Miller, Munro, McDorman, McKelvey and Tydemers, 2001).

FIGURE 3
Pacific Island States



Source: Munro, Van Houtte and Willmann.

the time of writing, the Treaty, as modified by the Agreement, has worked reasonably well since 1999. Whether the Treaty proves to be sustainable over the long run remains to be seen.

The final example, which I wish to consider in this section, is that of a cooperative resource management regime, which has displayed resilience through time, and which has dealt effectively with the curse of large numbers. It is, moreover, within hailing distance of its 30th anniversary. The cooperative management regime is the one among the Pacific Island States that are fellow members of Australia and New Zealand in the South Pacific Forum Fisheries Agency (FFA) (Figure 3).

It is well known that the Pacific Islands Region encompasses the richest tropical tuna resources in the world, which are, in turn, of high economic importance to the Pacific Island States. It could be argued that this group of states were among the big "winners" of the advent of the EEZ regime.

The Pacific Island States had a powerful incentive to cooperate. Some 80-90 per cent of the tuna harvests in the region were, and are, taken by distant water fishing states (DWFSs) (Aqorau, 2003). In the late 1970s-early 1980s, the Pacific Island States effectively faced only one DWFS, one that was a major power in the Asia Pacific region. As a provider of tuna harvesting services in the region, this powerful nation was in the position of a monopolist. In the absence of cooperation, it would have been inevitable that the single DWFS would have played one Island state against the other, and would have done so successfully (Munro, 1991).

The Pacific Island States did attempt to cooperate through the vehicle of the FFA, established in 1979. Achieving effective cooperation was, however, very difficult. There were some 14 Pacific Island State members of the FFA, varying greatly in size, with many at low levels of development. The distances were (and are) immense. The Pacific Island States are spread over 35 million square kilometres of ocean space, while having a combined land mass of only 500 thousand square millimetres (Aqorau, 2003).

Implementing effective monitoring and surveillance programs, appeared to be an insurmountably difficult task.

The point has already been made that establishing a stable cooperative arrangement with a large number of participants (players) is a demanding undertaking, in the best of circumstances. This author, writing 25 years ago, expressed the then widely shared pessimism about the stability of this seemingly intractable 14 player fisheries game (Munro, 1982).

In cooperative game theory, it is common to talk in terms of coalitions of players when the number of players exceeds two. The total number of players is thought of as the Grand Coalition, in addition to which there can be subcoalitions. One then has to be concerned, not only about the possibility of individual players defecting, but also the possibility of subcoalitions so doing.

The tuna resources in the South Pacific are not evenly spread throughout the region, but tend rather to concentrate around the Equator. The consequence is that there are, in relative terms, "haves" and "have nots" among the Pacific Island Nations. Seven of the fourteen could be regarded as "haves." Concerned about the lack of progress in the FFA, the seven met on the island of Nauru (one of the seven) and signed a formal agreement, the Nauru Agreement. The seven became known as the Nauru Group thereafter. The Nauru Group made it known that, while the Group had no wish to see the FFA disintegrate, the Group would go it alone unless the others engaged in serious cooperation. The others decided that serious cooperation was indeed in their best interest.

Two subcoalitions were thus formed, the Nauru Group ("haves"), and the "have nots." It helped that there are two major Pacific Island States, Papua New Guinea (PNG) and Fiji, which were in different subcoalitions. PNG was in the "haves" subcoalition, and became its leader, while Fiji became the leader of the "have nots" subcoalition. The intractable fourteen player game had evolved into what amounted to a game between two stable subcoalitions (Munro, 1991).

Not surprisingly, the management goals of the two subcoalitions were not the same. The Nauru Group was much more concerned about the long-term stability of the resources, than the less well off subcoalition. Clearly, the Nauru Group placed the higher value on the resource. As we have noted, the theory tells us that the optimal outcome would be for the management preferences of the subcoalition placing the higher value on the resource to be made dominant, and for that subcoalition to compensate its fellow subcoalition.

The predictive power of the theory in this instance proved to be strong. The Nauru Group became the cutting edge in terms of formulating management policy. Various forms of side payments emerged, through which the "have not" subcoalition was compensated (Aikman, 1987; Munro, 1991). These compensations continue up to the present day. Moreover, the "have nots" subcoalition has played an increasingly important role in the cooperative management of the resource (D. Doulman, FAO, personal communication), which attests to the growing strength and stability of the cooperative resource management arrangement – the Grand Coalition.

4. STRADDLING FISH STOCKS

It will be recalled that, in this paper, we are defining straddling fish stocks broadly to include all fish stocks to be found within the coastal State EEZ and the adjacent high seas. To repeat an earlier comment, in terms of the economics of resource management, there is no meaningful difference between straddling stocks, as defined by the FAO, and highly migratory stocks (Munro *et al.*, 2004).

Once again, I leave the detailed discussion of the legal framework surrounding such stocks to my colleagues on the panel. I shall content myself with the following observations. First, under the terms of the 1995 UN Fish Stocks Agreement, the resources are to be managed through Regional Fisheries Management Organizations

(RFMOs), as exemplified by the Western and Central Pacific Fisheries Commission, and the North Atlantic Fisheries Organization (NAFO). Under Article 8(4) of the Agreement, "only those States which are members of such an organization or participants in such an arrangement, or which agree to apply the conservation and management measures established by such organization or arrangement, shall have access to the fishery resources to which these measures apply" (United Nations, 1995, Article 8(4)). Whether this provision applies to all States, or only to those that have ratified the Agreement is a question, which I leave to my colleagues learned in international law. The second observation is that fleets of non-participants, which engage in exploitation of the high seas portion of stocks subject to RFMO management in a manner contrary to the management provisions of the RFMO, and do so, because the fleets' home states believe themselves not to be subject to Article 8(4) of the Agreement, or do so in defiance of the Article, are deemed to be engaging in unregulated, as opposed to illegal, fishing.

Economists, in exploring the economics of the management of straddling stocks, commence with the economics of the management of transboundary stocks, and then ask themselves what additions, or modifications, to the analysis, if any, are now required. With respect to non-cooperative management of straddling stocks, the answer is simple. The economics of non-cooperative management of transboundary stocks applies without modification. Non-cooperative management of straddling type of stocks leads directly to "Prisoner's Dilemma" type of outcomes.

Munro, Van Houtte and Willmann argue that weaknesses in the 1982 United Nations Convention, pertaining to high seas fishery resources, ensured that straddling type of stocks would be managed non-cooperatively, prior to 1995. The result was discord and overexploitation, as exemplified by the pollock resources of the Bering Sea "Doughnut Hole," and groundfish resources on the Nose and Tail of the Grand Bank of Newfoundland, which led ultimately to the 1993–1995 UN Fish Stocks Conference (Munro *et al.*, 2004). The three then go on to state that "... the overexploitation of straddling stocks [broadly defined] worldwide, which provided the rationale for the UN Fish Stocks Conference, bears powerful testimony to the predictive power of the economic analysis of the non-cooperative management of such resources" (Munro *et al.*, 2004, p.45).

It is in cooperative resource management that significant differences appear between transboundary and straddling stock management. The first difference is one of degree rather than kind. With respect to cooperative management of transboundary stocks, the FFA based cooperative regime is unusual in terms of its large numbers. Usually, the number of "players" is modest. In the cooperative management of straddling type stocks, a large number of "players" (and hence the curse of large numbers) is commonplace. The two following differences are differences in kind.

The second difference is in terms of the nature and number of participants (players) through time. In the case of transboundary stocks, the identity of those which should be involved in the cooperative management of a resource, or set of resources, is, with few exceptions, obvious. Moreover, the number of participants through time will be constant (again with few exceptions). As far as straddling type stocks are concerned, on the other hand, even the identity of the initial, or "charter," members of a given RFMO may not be entirely clear. Article 8(3) of the 1995 UN Fish Stocks Agreement maintains that: "... States having a real interest in the fisheries concerned may become members of such organizations," i.e. RFMOs, (United Nations, 1995, Article 8(3). Does this imply that the "charter" members of a RFMO should include, for example, DWFSs, which had hitherto never been involved in the relevant fisheries, but now would like to become so involved, and express a "real interest" to this effect? Munro, Van Houtte and Willmann found that experts in international law do not have a uniform view on the issue (Munro *et al.*, 2004, p.50, n.38).

With regards to the number (and nature) of participants of a RFMO over time, this may be anything but constant, since some of the participants are DWFSs, whose fleets are nothing, if not mobile. Possibly, some initial "charter" members of the RFMO may withdraw and abandon the relevant fishery(ies). More importantly, New Members/ Participants may appear and demand to be allowed entrance. Articles 8, 10 and 11 of the Agreement make it apparent that "charter" members of a RFMO cannot bar outright prospective New Members which are prepared to adhere to the RFMO management regime (United Nations, 1995; Munro *et al.*, 2004). The question is: under what terms are prospective New Members to be permitted to enter (e.g. what allocations are to be made to New Members)?

The third major difference between cooperative management of transboundary stocks, and that of straddling stocks revolves around the threat of "free riding." Munro, Van Houtte and Willmann (2004) make a distinction between non-compliance and "free riding," while conceding that the two are close, and that in some instances the boundary between the two will be fuzzy indeed. In using the term "non-compliance," they mean essentially cheating by participants in a cooperative arrangement. By "free riding," on the other hand, they refer to enjoyment of the benefits of, or returns from, a cooperative arrangement by non-participants.

Non-compliance is obviously an issue in the management of transboundary stocks. While the authors agree that "free riding" is conceivable in the case of transboundary stock management, they are hard pressed to come up with any real world examples.

By way of contrast, "free riding" is very much an issue in the cooperative management of straddling stocks, given the possibilities open for unregulated fishing in the high seas adjacent to the EEZs. The consequences of uncontrolled "free riding" are straightforward enough. With the prospect of much of the economic return from cooperative management being bled off by "free riders," "charter" members of a RFMO may calculate that their expected payoff from participating in, or remaining in, the cooperative arrangement would fall below their payoffs from non-cooperation – the "individual rationality" condition yet again. The stability of the RFMO could collapse.

In the pre-1995 United Nations Fish Stocks era, several efforts to manage straddling type of stocks, through cooperative management arrangements, were severely hindered by the "free riding" of non-participants, which were actively engaged in unregulated fishing. Clear cut examples are provided by NAFO (Bjørndal and Munro, 2003), and by the Commission for the Conservation of Southern Bluefin Tuna (CCSBT, 2006; Cox, Stubbs and Davies, 1999; Kennedy, 1999).

In addition to "free riding" through unregulated fishing, the New Member and "real interest" issues carry with them a more subtle variant of the "free rider" problem, quite separate from unregulated fishing. It arises in the following manner.

An international group of legal experts, T. McDorman, K. Sigurjonsson and P. Örebech maintain that, under the 1995 UN Fish Stocks Agreement, New Members must be allocated just and reasonable shares of the TAC(s), available under the RFMO management plan, (Örebech, Sigurjonsson and McDorman 1998). A number of years ago, Kaitala and Munro (1997) demonstrated the following. If *just and reasonable* implies that New Members/Participants, upon joining a RFMO, should be allocated, at no further cost as it were, shares of the Total Allowable Catch, or the equivalent, on a pro-rata basis, then, when planning is undertaken for the establishment of a RFMO, prospective "charter" members could well calculate that their expected payoffs from cooperation would fall below their respective non-cooperation payoffs. Hence, the RFMO would be stillborn, in essence because of potential New Member "free riding".

The Kaitala-Munro argument can be explained in terms of the following example. Suppose that a hitherto overexploited straddling type of stock comes under the

management of a RFMO consisting of coastal State V, and three DWFSs, W, X and Y, all of which had a history of involvement in the fishery. The four "charter" members undertake the cost and sacrifice of rebuilding the resource over, let us say, a seven year period. In the eighth year, the four are in a position to enjoy a return on their resource investment, through harvesting. At the beginning of the eighth year, a prospective new member, DWFS Z, appears. It demands access to the RFMO, agrees to abide by the resource management rules, but demands, "free of charge," a pro-rata share of the harvest, and by implication, a pro-rata share of the net economic returns from the fishery. If DWFS Z's demands were acceded to, Z would effectively be a "free rider." Having incurred none of the costs and sacrifices of investment in the resource, it will enjoy, at no cost, a pro-rata share of the return on the investment. A straightforward application of game theory demonstrates that the impact of this new form of "free riding" is no different from the impact of the "free riding" associated with unregulated fishing (Kaitala and Munro ibid; Munro *et al.* 2004).

The "real interest" issue raises a similar "free rider" problem. Munro, Van Houtte and Willmann argue that, if "real interest" as expressed in Article 8 of the Agreement, is interpreted to mean that States, not currently engaged in exploiting resources to come under the management of a RFMO, must be invited to become "charter" members of the RFMO, then the same sort of "free rider" problem, threatened by the New Member issue, can readily arise. Return to our New Member problem example, discussed in the previous paragraphs.

Suppose, as before, that States V, W, X, and Y come together to establish a RFMO to oversee the management of a straddling or highly migratory stock, which had, in the past, been overexploited. Suppose, also as before, that the four had been actively involved in the fishery prior to any thought being given to establishing a RFMO. The four plan to rebuild the resource over a seven year period. Let us suppose that DWFS Z is a state, which had never participated in the exploitation of the resource, but which has developed a "real interest" in the resource, now that it may come under effective management. Rather than wait to come in later as a New Member, Z demands full and undiluted "charter" membership. The four feel compelled to accede to Z's demand. Z incurs no real sacrifice in the re-building of the resource, because it had not hitherto been engaged in harvesting the resource. Z will simply bide its time over the seven year period, and then, when the eighth year arrives, will come to enjoy an allocated share of the return on the resource investment, as the "free rider" that it most certainly is. Once again, the possibility of such "free riding" could undermine the viability of the RFMO.

The Bergen Expert Consultation discussed two examples of attempts of RFMOs (or RFMO-like bodies) to address the New Member issue, namely NAFO and the Northeast Atlantic Fisheries Commission (NEAFC). Relevant to these examples is Article 11(a) of the 1995 UN Fish Stocks Agreement, which admonishes existing members of a RFMO, when preparing to accommodate new entrants, to take into account the status of the relevant stocks and existing fishing effort (UN 1995).

Munro, Van Houtte and Willmann comment that both NAFO and NEAFC are taking Article 11(a) with great seriousness. They conclude that "- to be blunt, a *just and reasonable* [allocated] *share* of the TACs for new entrants is interpreted largely as being what is left over" (Munro *et al.* 2004, p49).

There is, of course, an alternative, which is to allow prospective new entrants to buy quotas from existing RFMO members, similar to prospective new entrants to a domestic ITQ fishery attempting to buy quota from existing ITQ holders. The alternative was discussed at the Bergen Expert Consultation. The report of the Consultation states:

> If ... it were possible for prospective New Members to purchase quotas from existing members of RFMOs, this would serve to ease the problem of quota allocation to New Members (FAO, 2002, para. 63).

It was recognized in Bergen that, if this approach were to be adopted, then, by implication, the "charter" members of the RFMO would be granted de facto collective property rights to the fishery resources encompassed by the RFMO (Munro *et al.* 2004, p. 37).

This author is well aware that the New Member problem is of direct relevance to the WCPFC, and to the CCSBT. Information arising from the CCSBT makes it apparent that the Commission is encouraging those, which were hitherto engaged in unregulated fishing, to become New Members (CCSBT 2006). The author will not attempt to go into detail, but will, rather, defer to others on the panel, and at the Conference, whose knowledge of the two bodies far exceeds his own.

Having said all of this, an apparent dilemma now confronts us. If allocations offered to prospective New Members, or hitherto non-participants in the fishery(ies) now claiming a "real interest," are too generous, then the RFMO may be undermined for reasons discussed. If, however, States/entities found in these two groups deem the offered allocations to be insufficient, they may refuse to join the RFMO, and turn to unregulated fishing in the adjacent high seas, Agreement or no Agreement. How then is the dilemma to be resolved?

A group of European fisheries economists, who are, this author would argue, at the cutting edge of the application of game theory to the management of shared fish stocks, have, in the recent past, addressed this very problem.[93] Their conclusion is that, if restrictions on unregulated fishing are weak, there will be instances in which no resolution of the dilemma is possible– regardless of how ingenious the allocation schemes might be.[94]

In a recent study, the analysis developed by these economists was tested empirically by being applied to the case of East Atlantic Bluefin Tuna fisheries, under the management jurisdiction of the International Commission for the Conservation of Atlantic Tuna (ICCAT) (Pintassilgo, 2003). The author of the empirical study concludes that, if restrictions on unregulated fishing are weak, it will not be possible to achieve a stable (self-enforcing) cooperative arrangement for the management of the resource, the 1995 UN Fish Stocks Agreement notwithstanding. The author also concludes, however, that, if unregulated fishing can be eliminated, the prospects for effective cooperative resource management will be much brighter (Pintassilgo, ibid.). Another pair of European economists add that, if effective cooperative management measures are not applied to the tuna resource, the sustainability of the fishery will be under severe threat (Bjørndal and Brasão, forthcoming).

The implications of the preceding analysis and empirical studies are clear, and unambiguous. In his keynote address to the International Institute of Fisheries Economics and Trade (IIFET) 2004 Japan Conference, Assistant Director General, Ichiro Nomura, FAO, stated that "... if Regional Fisheries Bodies [including RFMOs] are not able to fulfil their mandates because of IUU fishing, the outlook for the sustainable utilization of many of the world's commercially important fish stocks is bleak." (Nomura, 2004, p.7). This author can only agree. If the newly emerging RFMO regime is to prosper, it is of utmost importance that unregulated fishing be eliminated,

[93] See in particular: Lindroos (2002); and Pintassilgo (2003).

[94] In the straddling stock cooperative fisheries game, as we have emphasized, large numbers of "players" is the norm. Let it be recalled that, when there are a large number of players, it is not sufficient to worry about individual players going off on their own and playing non-cooperatively. One also has to worry about sub coalitions defecting. One should also point out that it is not just frustrated potential New Members, which might engage in "free riding." "Charter" member DWFSs could announce their withdrawal from the RFMO and proceed to become "free riders."

with the first such fishing becoming, de facto if not de jure, illegal fishing.[95] It is difficult to overstress the importance of the FAO International Plan of Action to deal with IUU fishing (IPOA-IUU) (FAO, 2001).

5. DISCRETE HIGH SEAS STOCKS

There is very little that one can say, at this stage, about these stocks. Munro, Van Houtte and Willmann describe them as the "orphan" fish stocks of the ocean (Munro *et al.*, 2004, p. 57). Many of the stocks have been protected to date, by virtue of the fact that it is too costly to exploit them on a commercial basis. The history of world fisheries assures us that, with the ongoing advance of fisheries technology, this protection will disappear over time.

Munro, Van Houtte and Willmann point out that the only legal protection, which the resources have, comes from the 1982 UN Convention, Part VII, High Seas (UN, 1982). States exploiting such stocks are admonished to cooperate for the purpose of conserving the resource. Needless to say, no mechanism for cooperation is suggested.

Part VII of the 1982 Convention did, in of and by itself, prove to be quite inadequate for the conservation of straddling type of stocks. It is questionable whether one has any justification whatsoever for assuming that Part VII articles will prove to be any more adequate for the conservation of discrete high seas stocks. One could look forward, with confidence, to an intractable "free riding" problem.

Without an effective mechanism for cooperation, we can anticipate that the discrete high seas stocks fisheries will play themselves out as competitive fisheries games, with the to be expected destructive consequences. It may be that a solution could be found in extending the mandate of RFMOs to cover these resources. At this point, we can do no more than speculate.

6. CONCLUSIONS

This paper has been concerned with allocation issues, in the context of internationally shared fishery resources, as seen from the perspective of an economist. The key question that has been raised is whether there exist allocation schemes that will ensure the long run stability of the fisheries, which these resources support. The answer is that, while allocation schemes, deemed to be fair and equitable, are clearly important for the long run stability of internationally shared fisheries, they are not sufficient, in of and by themselves.

We commence with two fundamental propositions. The first is that, with few exceptions, there will be a strategic interaction between, and among, the States/entities sharing the fishery resources. The second is that cooperative arrangements, for the management of such resources must be self-enforcing, if they are to be sustainable over the long run.

Given the first proposition, economists, in analyzing the management of internationally shared fishery resources, have been compelled to view the problem through the lens of the theory of strategic interaction, popularly known as game theory. In so doing, we are driven to our first conclusion, namely that, if the cooperative management arrangement breaks down, the consequences can be severe, with there being little left to allocate over the long term.

Self-enforcing cooperative resource management regimes are those in which no participant ("player"), now or in the future, does have, or will have, an incentive to defect, and go it on its own. To achieve this goal, cooperative management regimes for

[95] The single most important emerging RFMO, where these problems are being played out, is on this Conference's doorstep, namely the Western and Central Pacific Fisheries Commission (see: Figure 3). Munro, Van Houtte and Willmann maintained that "... the WCPFC represents an immensely ambitious undertaking. If it is successful, one can anticipate that it will serve as a model for emerging RFMOs throughout the world" (Munro *et al.* 2004, p. 55).

both transboundary and straddling stocks must, we have now learned, be "resilient", in that they can withstand unpredictable shocks. Straddling stock cooperative management regimes face an additional threat in the form of "free riding". We conclude that, unless the problem of unregulated fishing can be dealt with effectively, the threat posed by "free riding" will be chronic, and could undermine the emerging RFMO regime. There remain discrete high seas stocks, which we referred to as the "orphans" of the sea. At the time of writing, we have little assurance of self-enforcing, stable cooperative regimes being established for their management. The threat posed by "free riding" is, at best, daunting.

APPENDIX A

Non-cooperative management of shared fish stocks and the "Prisoner's Dilemma"

This appendix draws heavily upon Munro, Van Houtte and Willmann 2004 (see pp. 61-63).

The "Prisoners' Dilemma" is perhaps the most famous of all non-cooperative games. The name arises from a story introduced by the author (Tucker, 1950) to illustrate the point that, under non-cooperation, the players will be driven to adopt strategies, which they know are less than optimal.

In the story, two men, R and T, are arrested on (justifiable) suspicion of grand larceny. In prison, the men are isolated from one another, so that no cooperation between the two is possible. The state prosecutor then interviews prisoner R. The prosecutor admits that the evidence, which he has, is limited. He concedes that, if both R and T plead not guilty, the most he can do is to convict the two on a lesser charge. They would then each receive 6 months in prison. If both R and T plead guilty, they will each receive a 5-year prison sentence. The prosecutor continues that, if R pleads guilty, while T pleads not guilty, R will be released for having turned state's evidence, and thus helping to convict T. If, on the other hand, R pleads not guilty, while T pleads guilty, R will be dealt with harshly. He will receive a 10-year prison sentence. The prosecutor then holds exactly the same interview with T.

R and T are the players. Each has two possible strategies: to plead guilty, or to plead not guilty. If R and T could communicate, and were able to enter into a binding agreement, they would cooperate, and each would adopt the strategy of pleading not guilty. The outcome of the cooperative game would be that the two would be released from prison after a short stay of 6 months. They cannot communicate, however, with the result that they cannot cooperate. A non-cooperative game is the only option. In this situation, the best strategy for R will be to plead guilty. What is true for R is also true for T. The two will thus spend 5 years in prison, a most inferior outcome.

To see why we get this seemingly perverse "solution" to the non-cooperative game, we set up a so-called Payoff Matrix. The payoffs in the Matrix are expressed in terms of prison sentences. Consider the following, adapted from Luce and Raiffa (1957):

Prisoner R\Prisoner T	Pleads guilty	Pleads not guilty
Pleads guilty	5 years each	0 years for R, and 10 years for T
Pleads not guilty	10 years for R, and 0 years for T	1/2 year each

Consider the position of R. If Player T were to plead guilty, Player R would clearly be better off pleading guilty. If Player T were to plead not guilty, Player R would, once again, be better off pleading guilty. Regardless of which of the two strategies Player T may adopt, the best strategy for Player R is to plead guilty. Hence, pleading guilty is the dominant strategy for Player R. What holds true for Player R, also hold true for Player T.

Colin Clark, in his book *Bionomic Modelling and Fisheries Management* (Clark, 1985), presents a lucid example of the Prisoner's Dilemma applied to fisheries. Consider a fishery resource, shared by two countries, in which the costs of harvesting are independent of the size of the biomass, and in which the price for harvested fish and unit fishing effort costs are the same for the two countries, and are both constants. For each country, the net return for each unit of fish harvested is p-c, where p is the price of harvested fish and c the unit cost of harvesting. For the sake of simplicity, let p-c=1.

Let x denote the biomass, and G(x) the growth of the biomass, and thus the sustainable harvest for any given level of x. Suppose that we commence at the global optimal biomass level, i.e. the biomass level at which the global economic returns from the resource will be maximized. Denote that biomass by x*. The global economic return from the resource at x = x* is the present value of the sustainable harvest through time, which can be expressed as: G(x*)/ , where is the appropriate rate of interest, or discount rate, assumed to be common to the two countries.

One possible harvest policy is simply to deplete the resource. Since harvesting costs are independent of the size of the resource, the resource could be reduced to zero. If, commencing at x = x*, the resource is depleted to zero, the economic return from so doing would be just x*. We assume that x* is positive, which implies, in turn, that x * < G(x*)/ .

Country 1 has two possible strategies: deplete the resource, or conserve it. If Country 1 adopts the deplete strategy, while Country 2 follows the conserve strategy, it is assumed that Country 1 can deplete the resource so quickly that Country 2 receives nothing (and thus ends up as the "goat"). What holds true for Country 1, holds true for Country 2, which faces the same set of strategies.

Finally, we assume that the two countries have equal bargaining strength and harvesting power. Hence, if the two follow the same strategies, they will share the economic returns from the fishery equally.

The Payoff Matrix looks as follows:

Country 1/Country 2	Conserve	Deplete
Conserve	$\frac{G(x^*)}{2}, \frac{G(x^*)}{2}$	0, x*
Deplete	x*,0	$\frac{x^*}{2}, \frac{x^*}{2}$

If both conserve, each will receive one-half of the present value of the sustainable harvest, i.e. $\left(\frac{G(x^*)}{\delta}\right)\times\frac{1}{2}$. If both deplete, each will receive $\frac{x^*}{2}$. Since $\frac{x^*}{2}<\left(\frac{G(x^*)}{2\delta}\right)$, then it follows that, if the two countries could communicate with one another and were prepared to cooperate, and enter into a binding agreement, we would end up with the resource being conserved.

Suppose, on the other hand, that there is no cooperation, no communication, between the two countries. Assume, to begin with, that $x^* > \left(\frac{G(x^*)}{2\delta}\right)$ and consider Country 1. If Country 2 should follow the conserve strategy, Country 1 will receive $\frac{G(x^*)}{2\delta}$, if it conserves, and x*, if it depletes. If Country 2 should follow the deplete strategy, Country 1 would receive 0, if it follows the conserve strategy, and $\frac{x^*}{2}$ if it follows the deplete strategy. Clearly Country 1 should adopt the deplete strategy. What holds true for Country 1, hold true for Country 2, and we end up with a deplete, deplete outcome. This is a perfect Prisoner's Dilemma case (Clark, 1985, pp.151-153).

Suppose, on the other hand, that $x^* < \left(\frac{G(x^*)}{2\delta}\right)$. Country 1 would be better off conserving, if Country 2 followed the conserve strategy. It is possible that we would end up with a conserve, conserve outcome (tacit cooperation). But, such an outcome is decidedly unstable. Suppose that Country 1, guessing that Country 2 will conserve, adopts the conserve strategy, but is then proven wrong. Country 2 depletes, with the result that Country 1 is left with 0, and is indeed the "goat."

There is, in the theory of games, a famous criterion for selecting strategies in non-cooperative games, which is particularly applicable when one's opponent is both aggressive and unpredictable. It is referred to as the maxmin criterion. The criterion states that one should look at the worst possible outcome from following each strategy, and then compare. Choose the strategy having the least worst outcome. In

the case under discussion, $x^* < \left(\frac{G(x^*)}{2\delta}\right)$, the Payoff Matrix tells us that the worst outcome for Country 1, if it follows the conserve strategy, is that it will receive 0 (the "goat" outcome). The worst outcome for Country 1, if it follows the deplete strategy, is that it will receive $\frac{x^*}{2}$. An application of the maxmin criterion would lead Country 1 to choose the deplete strategy. If Countries 1 and 2 each regard one another as aggressive and unpredictable, we can look forward to a deplete, deplete outcome. We might refer to this as the imperfect Prisoner's Dilemma case (Clark, 1985, ibid.; Bacharach, 1976).

APPENDIX B

A two player cooperative fisheries game and side payments

In this appendix, we attempt to illustrate more fully some of the points made about simple cooperative fisheries games.

In the example to follow, we assume two players - two coastal States sharing a transboundary fishery resource. Call the players simply Player I and Player II. The payoffs to the players are expressed in terms of the present values of the expected net economic returns to the players from the fishery, given a particular harvest program.

We now introduce some economic jargon. The late 19th century-early 20th century Italian economist, Vilfredo Pareto, put forth the proposition that, in trade or in other dealings between and among "individuals," the outcome was certain to be less than optimal, if it were possible by a rearrangement of the dealings to make one "individual" better off, without making the other "individual" worse off. This gave rise to the expressions "Pareto Improving" and "Pareto Optimality." "Pareto Optimality" implies a situation, in which it is not possible to make one "individual" better off, except at the expense of the other(s). A formal condition for the stability of a "solution" to a cooperative game is that the "solution" be "Pareto Optimal." This fits in with our discussion in the text of the necessity of attempting to maximize the global net economic returns from the cooperatively managed fishery.

Now consider the following widely used diagram. We assume that, for whatever reason, Players I and II have different management goals and that Player I places a higher value on the fishery resource than does II. The payoffs to I, , are shown on the vertical axis; while the payoffs to II, , are shown on the horizontal axis.

The payoff 0 represents the payoff I would receive, if there was no cooperation. I cannot receive less from the cooperative game than 0, if there is to be a "solution" to the game. In the case of II, we have two alternative cases, one in which its payoff from non-cooperation is 0, the second case in which its payoff from non-cooperation is '0.

Now suppose that side payments are barred. The curve =1 to = 0 represents the so called Pareto Frontier. It shows all of the pairs of payoffs to all possible solutions to the cooperative game meeting the criterion of Pareto Optimality. If a "solution" to the game exists, it must lie on this frontier.

The parameter is a bargaining parameter. If = 1, the resource management preferences of I are completely dominant, while if = 0, those of II are completely dominant. If 0 < < 1, we have a compromise resource management program.

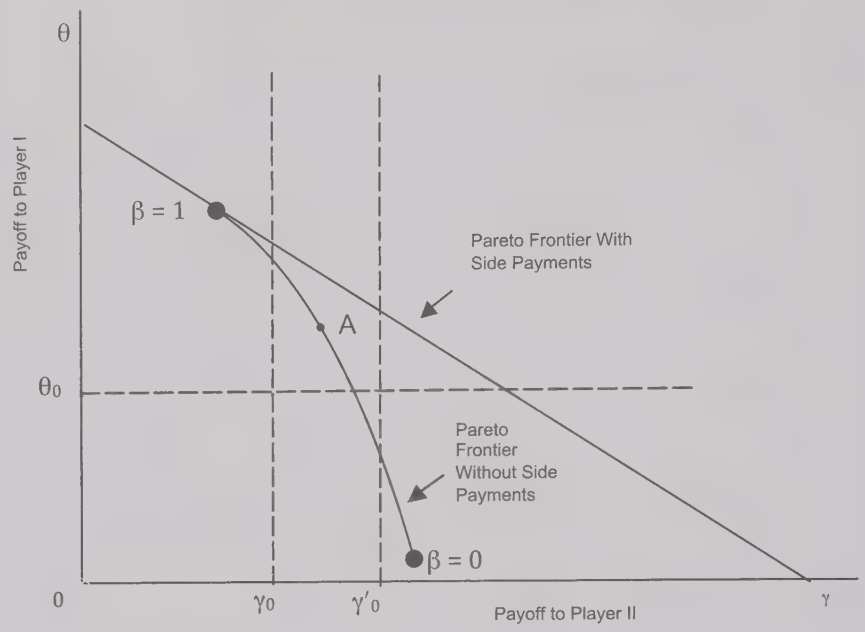
Suppose now that the payoff, which II would receive under non-cooperation is 0. We can see at once that a solution to the cooperative game in which the management preferences of I, the player placing the highest value on the resource, are dominant, is not feasible. Player II would end up being worse off than it would be under non-cooperation. The "individual rationality" condition would not be met.

A "solution" to the game would be achievable; however, say at point such as A. Point A is Pareto Optimal. Furthermore, both players will receive payoffs greater than they would under non-cooperation.

On the other hand, if II's expected payoff from non-cooperation is '0, there would be no "solution" to the cooperative game. There is no point on the Pareto frontier at which both I and II are assured of being better off than they would be by acting non-cooperatively. Attempts to achieve cooperation would break down. A non-cooperative game would ensue.

Now suppose that side payments are feasible. The Pareto Frontier then becomes a 45 line, implying that the two players attempt to maximize the global returns from the fishery, without worrying about differences in management preferences. This will

FIGURE 4
Cooperative Game With, and Without, Side Payments



be achieved by allowing the management preferences of I to prevail, i.e. we end up at = 1. Player I will manage the fishery, and will make transfers to II to ensure II's cooperation.

II will be clearly better off when the side payments are feasible, but so will I. If II's payoff under non-cooperation is '0, the existence of side payments will make the difference between cooperation and non-cooperation. If II's non-cooperative payoff is 0, the impact of the introduction of side payments is not so dramatic. Nonetheless, I, as well as II, can expect to be better off. By allowing side payments, the global net economic benefits from the fishery can be maximized, which they cannot in the absence of side payments. The introduction of side payments is "Pareto Improving," – both players can expect to win.

Return to the real world example of the North Pacific fur seal fishery. Think of Russia plus the United States as the equivalent of I, and Canada plus Japan as the equivalent of II. The cooperative resource management arrangement, by allowing for superior economic management, meant that Russia and the United States, as well as Canada and Japan, were better off than they would have been had the arrangement called for continued Canadian and Japanese high cost harvesting.

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Regional allocation issues or Zen and the art of pie cutting

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1. INTRODUCTION

The discipline of Zen consists in attaining enlightenment. According to the Zen school of thought, freedom is not enlightenment. Rather, freedom is the outcome of enlightenment which is attained through the rigorous application of two approaches. The first approach, that of verbalism, requires one to "examine the living words and not the dead ones".[96] Dead words are "those that no longer pass directly and correctly and intimately on to the experience. They are conceptualized, they are cut off from the living roots".[97] The second, or 'actional' approach, consists in taking action which has as its deeper purpose the "awakening in a disciple's mind [of] a certain consciousness that is attuned to the pulsation of Reality".[98] From an international lawyer's perspective, the intriguing thing about Zen philosophy is that these two approaches appear to mirror those taken in the development of international law, in particular customary international law, which requires evidence of opinio juris and state practice.

If we apply Zen philosophy to the high seas fisheries context, the alleged freedom to fish is not enlightenment. Enlightenment is, instead, to be attained through the implementation of a fisheries regime which ensures, in light of changing experiences and realities, the long-term sustainability of fish stocks. Only when that goal is achieved will enlightenment, and hence true freedom, be achieved. In the context of the topic of allocation, attainment of enlightenment requires devising allocation strategies to divide ever decreasing resources among ever increasing numbers of exploiters in a manner that both ensures the long term sustainability of the resource and is acceptable to all.

This paper examines the search by Regional Fisheries Management Organizations (RFMOs) for enlightenment in the context of the allocation of high seas fish stocks. Although allocation is essentially a political, or negotiated, process, in devising their allocation strategies RFMOs and their member states act within the context of a wide-ranging body of legal principles. This body of law is, however, still developing.

Moreover, as states seek new ways to deal with constantly emerging realities, these principles may come into conflict with each other or their legal status may be controversial. In other words, RFMOs are operating in a changing international legal environment that reflects the ongoing tension between the state sovereignty and international communitarian models. Accordingly, rather than focus on political or economic aspects, or on the practice in one or more RFMOs as will be done in

[96] D. T. Suzuki. 1959. Zen and Japanese Culture. Princeton University Press, Princeton, NJ. p. 7.
[97] Ibid.
[98] Ibid. p9.

other papers, this paper presents a broad overview of the legal principles that apply to the who, what, why, when, where, and how of allocation decisions by RFMOs. It concludes with some suggestions for a reconceptualization of the legal regime which might bring us closer to the elusive goal of enlightenment in the context of regional allocation issues.

2. LEGAL PRINCIPLES APPLICABLE TO ALLOCATIONS WITHIN RFMOS

2.1 Who allocates?

The first set of principles relate to the question of who has the right to allocate high seas fisheries. It seems beyond doubt that RFMOs are now the accepted *modus operandi* through which international cooperation in the conservation and management of high seas fisheries is to be carried out.[99] Articles 116-118 of the Law of the Sea Convention (LOSC)[100] provide that the duty to cooperate in respect of the conservation and management of high seas fish stocks is to be carried out through the establishment, where applicable, of RFMOs. This is further reinforced by Article 8 of the Fish Stocks Agreement (FSA)[101] which institutionalises the duty to cooperate through the medium of RFMOs by providing that only members of RFMOs or non-members which agree to abide by the conservation and management measures adopted by RFMOs can access the fishery concerned.

However, the efficacy of allocations made by RFMOs is affected by the operation of a number of legal principles. First, the freedom to fish on the high seas, while often overstated, nevertheless means that, subject to certain restrictions, the vessels of any state, including states that are not members of an RFMO, may fish on the high seas within the regulatory area of that RFMO. These restrictions include the general limitations of 'due regard'[102] and 'peaceful purposes'[103] as well as the specific limitations arising from states' treaty obligations, the rights, duties and interests of coastal states in straddling and anadromous fish stocks, highly migratory and catadromous species and marine mammals, and the duties of conservation, cooperation and non-discrimination in respect of the conservation and management of the living resources of the high seas.[104] Arguably this circumscribed 'freedom' is also now exercisable either only by members of RFMOs or by non-member states parties that agree to abide by the conservation and management measures adopted by an RFMO. This restriction, found in the FSA,[105] is however, not yet universally accepted as binding on all states as a matter of customary international law. Thus, its application appears to be limited to parties to the FSA.

Next, the *pacta tertiis* rule, which provides that treaties do not bind third, or non-party, states,[106] operates to exempt non-members and non-parties to the FSA from the application of an RFMO regime. The effect is that allocation decisions can only be made in respect of members. Even assuming RFMO allocations are adhered to by member states, which is often not the case, their efficacy is compromised by the inability of an

[99] In truth, this is something of an overstatement. Cooperation can be through mechanisms other than formally established RFMOs. The terminology of RFMO is used here as shorthand to encompass all cooperative participatory agreements and arrangements for the management of high seas fisheries resources.

[100] United Nations Convention on the Law of the Sea, 10 December 1982, 21 ILM 1245 (hereinafter LOSC).

[101] Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, 8 September 1995 34 ILM 1542 (hereinafter, FSA).

[102] LOSC Art 87(2).

[103] LOSC Art 88.

[104] LOSC Arts 116 – 120. See Rosemary Rayfuse. 2004. Non-Flag State Enforcement in High Seas Fisheries. Martinus Nijhoff,. p.30-34.

[105] FSA Art 8.

[106] Vienna Convention on the Law of Treaties, 23 May 1969, 1155 UNTS 331 Arts 34-38.

RFMO to require submission of catch and effort data from non-members. In other words, allocations will be based on incomplete scientific information and will therefore be unreliable and possibly unachievable or unsustainable.

The principle of exclusivity of flag state jurisdiction further limits the effectiveness of RFMO allocations. As noted above, RFMOs have no legal standing to enforce their allocation regimes, or any other part of their mandate, against non-members. Thus, the phenomenon commonly referred to as Illegal, Unreported and Unregulated (IUU) fishing appears to continue almost unabated. However, IUU fishing is not confined to non-members of RFMOs but is also carried out by nationals of member states. Nevertheless, while progress is being made, RFMOs still lack comprehensive and effective compliance and enforcement regimes in respect of their members[107] who, it is acknowledged, may see little advantage, commercial or otherwise, in compliance with limitations on their fishing effort when non-members are not so bound. Thus IUU fishing is often said to be at the root of the allocation issue.

The question of 'who can allocate' also relates to the issue of participation in RFMOs. Not addressed in the LOSC, the FSA provides that "states having a real interest in the fisheries concerned may become a member" of RFMOs.[108] What, precisely, a 'real interest' is, however, is still not clear.[109] Argument persists as to whether the category encompasses only states with a pre-existing fishing history and relevant coastal states, or is also open to new entrants or other states with no such attachment but only a general interest in, for example, the conservation of living marine resources or global biodiversity. Molenaar suggests that no rational argument exists to interpret or apply the concept of real interest to bar states in these latter categories from membership in RFMOs.[110] Nevertheless, some RFMOs do make membership contingent on fishing interest. Others, while not limiting membership in this way, make membership contingent on allocation, while still others are prepared to offer membership but no allocation.[111]

While any state may accede to the Convention on the Conservation of Antarctic Marine Living Resources, membership in the Commission on the Conservation of Antarctic Marine Living Resources (CCAMLR) is only open to states which are actively engaged in research or harvesting activities within the Convention area.[112] Similarly, any state may accede to the Convention on Future Multilateral Cooperation in the North-West Atlantic Fisheries; however, membership of the Fisheries Commission of the Northwest Atlantic Fisheries Organization (NAFO) is limited to states already engaged in fishing in the NAFO Regulatory area or those that provide satisfactory evidence that they intend to do so during the relevant year.[113] However, membership applications will not succeed if the prospective member has no allocation. The apparent circularity of this is overcome by the practice of offering new entrants allocations of fishing opportunities for stocks not currently allocated.[114] While the Republic of Korea and Taiwan Province of China successfully negotiated allocations before joining the Commission on the Conservation of Southern Bluefin Tuna (CCSBT) the Commission

[107] See R. Rayfuse. 2005. "To Our Children's Children's Children: From Promoting to Achieving Compliance in High Seas Fisheries", International Journal of Marine and Coastal Law 20(3-4):509-532.

[108] FSA Art 8(3).

[109] E. J. Molenaar. 2000. "The Concept of 'Real Interest' and Other Aspects of Cooperation through Regional Fisheries Management Mechanisms", International Journal of Marine and Coastal Law 15:475-531.

[110] Ibid. p496-498.

[111] E. J. Molenaar. 2003. "Participation, Allocation and Unregulated Fishing: The Practice of Regional Fisheries Management Organisations", International Journal of Marine and Coastal Law 18(4):462-466.

[112] Convention on the Conservation of Antarctic Marine Living Resources, Art VII.

[113] NAFO Convention Arts IV(1), XII(4) and XIII(1).

[114] See NAFO Resolution to Guide the Expectations of Future New Members with Regard to Fishing Opportunities within the NAFO Regulatory Area, adopted at the 21st Annual Meeting of NAFO, September 1999.

initially refused to grant an allocation to South Africa should it join the Commission. After several years of debate, the Commission has recently agreed to make a 'final' offer of a 45 tonne catch limit to South Africa in return for it becoming a cooperating non-member. This is less that the 60 tonne allocation requested by South Africa.[115]

None of these approaches encourages new entrants, and each merely encourages unregulated fishing. Moreover, each of these approaches arguably discriminates in fact, if not in form, against new entrants and developing states which have not previously had the capacity, be it legal or practical, to engage in high seas fisheries. As Molenaar points out, the concept of cooperating non-member has been adopted by a number of RFMOs in an attempt to woo compliance from non-members. These states may receive allocations and they may also be exempt from measures designed to deter IUU fishing.[116] The status of cooperating non-member is, however, not a permanent one but is subject to annual renewal by the RFMO concerned. While clearly designed to encourage eventual membership, this may, instead, merely result in further discrimination against developing state non-members which may be held to higher levels of compliance with the RFMO regime than the members themselves.

2.2 What is being allocated?

The next set of principles relates to the question of what is being allocated. International law does not currently recognise any property rights in high seas fisheries. In other words, no one owns the fish.[117] RFMOs can therefore not allocate fish. They can, however, allocate fishing opportunities as between their members. This is recognized in Article 10 of the FSA which refers to participatory rights such as allocations of allowable catch or levels of fishing effort. Nevertheless, as all states have the freedom to fish on the high seas, any participatory rights allocated by an RFMO will only ever be relative at best, and hence, imperfect.

RFMO members may distribute these imperfect rights among their nationals as, for example, in the provision of individual quotas, the sum total of which do not exceed the internationally agreed national allocation. Member states operating in this manner are responsible for their nationals and, to that end, must ensure, through adequate compliance and enforcement mechanisms, that the overall national allocation is not exceeded. If it is, the member state will be internationally responsible to other RFMO members for its breach of its allocation. The consequences of such a breach are, however, unclear. Acts of retorsion[118] or countermeasures[119] may be adopted by other individual members of the RFMO. Alternately, the RFMO may take steps against recalcitrant members. Traditionally, these steps have involved the development of reporting procedures aimed at 'naming and shaming' in compliance committees or similar RFMO bodies. A more interesting concept has been adopted in the International Commission on the Conservation of Atlantic Tunas (ICCAT) by which overages in one year must be deducted from allocated amounts in future years. More recently, ICCAT has gone further and drastically reduced the Taiwanese allocation in response to Taiwan Province of China's continued involvement in IUU fishing.

RFMO members may wish to transfer all or part of their national allocation to other members. Although an imperfect right, this right can be transferred to other

[115] CCSBT. Report of the Extended Commission for the Twelfth Annual Meeting of the Commission, Report of the Twelfth Annual Meeting of the Commission, 15 October 2005, paras. 72-74.

[116] Ibid. p466.

[117] This is subject to the exception of coastal state interests in anadromous stocks, catadromous species and sedentary species on the extended continental shelf as per LOSC Arts 66–68.

[118] These are acts that although perfectly lawful are regarded as 'unfriendly'.

[119] Countermeasures are unlawful acts the unlawfulness of which is excused because they are taking in response to a prior unlawful act and meet certain criteria relating to proportionality, necessity and temporal limitations. See R. Rayfuse. 2004. "Countermeasures in High Seas Fisheries". Netherlands International Law Review 51(2):41-76.

members by agreement if the RFMO regime allows or does not otherwise prohibit it. Where allocation is transferred the receiving member state will become responsible internationally for adherence to it. However, where effort – as opposed to allocation – is transferred, as through the chartering out of vessels flagged in one member state to another member state the attribution of responsibility becomes less clear. While the flag state will prima facie be responsible under the principle of exclusive flag state jurisdiction, the chartering state may also be responsible as a member of the RFMO and questions of joint and several responsibility will arise. Moreover, questions may arise as to whose allocation the vessel is fishing against. ICCAT regulates chartering arrangements for its members pursuant to Recommendation 02-21 on Vessel Chartering. Vessels may only be chartered from other ICCAT members or cooperating non-members and both states are responsible to ensure compliance by the vessel with ICCAT measures. Both states are obliged to record the catch and to do so separately from catches taken by other vessels. However, catches taken count against the allocation of the member who charters the vessel. Similarly, Article 15 of the NAFO[120] Conservation and Enforcement Measures dealing with chartering arrangements allows charters as between NAFO members with the flag state being responsible to ensure compliance with NAFO measures and the chartering member, which is the member state to whom the allocation was originally made, being responsible for compliance with its own allocation limits.

RFMO members may also wish to transfer all or part of their allocation to non-members. Such transfers may serve three purposes: (1) they may act as an incentive for procuring non-member membership in the RFMO; (2) they may be used to allow new entrants to establish a fishing history to allow them to meet membership criteria; and (3) they may provide a revenue source for the transferring state. Referred to as 'quota trading' in the CCSBT, in 2003 the Republic of Korea proposed to sell its national quota to non-member South Africa which had been refused an allocation by the Commission in return for membership. However, the suggestion that a state should have to purchase an imperfect right to fish for a species on the high seas flies in the face of the traditional rules of freedom of fishing, and even more so where that state is a coastal state through whose waters the species passes and which has the right to fish for that species within its exclusive economic zone in any event. Nevertheless, it is always open to states to agree to fetters on their sovereign rights, including the freedom of fishing on the high seas. In doing so, however, the issue becomes one of enforcement and responsibility for breaches by the non-member state of the purchased allocation. By virtue of the pacta tertiis rule the RFMO cannot enforce against the non-member (unless that non-member is a party to the FSA). Thus, by effecting transfers of this sort the member state may be open to the charge that it is undermining the RFMO regime contrary to the basic principles of good faith.

2.3 When to allocate?

The third set of principles relates to the question of when RFMOs should engage in an allocation exercise. Traditionally RFMOs have only sought to regulate allocation of stocks or species once decline in biomass has been noted, in other words, once overfishing has already occurred. Allocation exercises then become a race to the bottom with member states reluctant to accept any lower than their historically highest catch as their allocation, even despite sound scientific advice that such allocations will drive the stock or species concerned into commercial or biological extinction. Perceived or genuine lack of scientific knowledge, ponderous decision-making processes, and

[120] Northwest Atlantic Fisheries Organization.

objection procedures[121] often render nugatory regulatory efforts to reach scientifically meaningful allocation decisions. Moreover, many stocks and species currently subject to exploitation are not regulated in any way and these are the fisheries into which new entrants are often pushed.

Arguably allocations should be set on any fishery from its inception. This strategy is followed in the Commission on Conservation of Antarctic Marine Living Resources (CCAMLR) which sets precautionary catch limits on all new and exploratory fisheries in the Convention area. This is not to suggest that the limits set are necessarily biologically astute. However, catch limits can be amended over time as more data on stock status becomes available. In this respect it is worth noting that initial limits should be, but often are not, set at both a precautionary and conservative level, as once a fishery is established reducing allocations is notoriously difficult. To give but one example, despite accepted scientific advice of the need to reduce allocations in the CCSBT members have consistently deferred taking and actioning the hard decision which, in 2005 was put off yet again until 2007. In short, as the human propensity is to overexploit and protect their right to do so, allocations should be set, and be set carefully, from the start of, and in respect of all fisheries.

2.4 Why allocate?

The purpose of allocating high seas fishing opportunities is simple; to avoid overfishing and the inevitable tragedy of the commons that comes from overexploitation of an open access resource. As Molenaar notes, this is one of the core objectives and principle functions of an RFMO.[122] As a matter of basic treaty law, RFMOs play this role in respect of their members only. Increasingly, however, RFMOs have been institutionalized as custodians of the resources under their mandate for the entire international community with all states being required either to comply with the measures adopted by RFMOs or refrain from fishing.[123] The role of RFMOs should therefore now be to ensure that as an open access resource, the resource continues in a long-term and sustainable manner to be available to all states on an equitable and non-discriminatory basis.

2.5 Where to allocate?

An important, and controversial, set of principles relate to the area over which RFMOs may exercise their allocational jurisdiction, or the issue of where allocations are to be made. The difficulty here arises from the conflict of interests between coastal states and high seas fishing states over straddling and highly migratory fish stocks, most famously highlighted by the Canadian arrest of the Spanish vessel the Estai in 1995 when Canada alleged that the high seas fishing activities of the Estai were undermining its own fisheries within its EEZ. While coastal states may, and do, arrest vessels for illegally fishing within their EEZ, as in Australian and French arrests of foreign flagged vessels fishing for Patagonian toothfish within their waters, the international community has been less than enthusiastic about following Canada's example.

The crux of the matter lies in the possible differences between the management regimes. A coastal state may strictly regulate access to a stock. However, its conservatory actions may be nullified by un-, or insufficiently, regulated fishing for the same stock in the high seas part of its range. This seems to have been at the heart of the dispute between Chile and the EU over swordfish fishing in the Eastern Pacific

[121] T. McDorman.2005. "Decision Making Processes in RFMOs". International Journal of Marine and Coastal Law. 20(3-4).

[122] Molenaar, supra note 17 p466.

[123] FSA Art 8.

Ocean.[124] Alternately, an RFMO may strictly regulate access to a stock but a coastal state in whose waters the stock is also found may not. In a strange turn of events at NAFO, it will be recalled that while the NAFO moratorium on high seas fishing for cod was in place Canada reopened its domestic cod fishery, thereby raising the ire of its NAFO partners.[125] Admittedly the opening was short-lived. After four years it was obvious that there were simply no cod to be had and the fishery was closed permanently. Coastal states seeking membership in RFMOs who have been denied allocations may similarly engage in heavy exploitation of a stock while it is within their EEZ thereby undermining the RFMO regime and possibly creating a situation of overexploitation. South Africa has repeatedly expressed its desire to join the CCSBT but to do so in return for an allocation of the overall SBT catch. The Commission has repeatedly refused to give South Africa an allocation. South Africa can, of course, fish for SBT within its own EEZ without any allocation from the Commission - a situation of no benefit to the stock (or the Commission).

One view, traditionally held by high seas fishing nations has been that RFMOs should have the power to regulate, and allocate, in respect of a stock throughout its range. The contrary view, held by coastal states is that costal states should have that power. Chile's claim to a Presential Sea[126] and the Canadian concept of 'custodial management' of the straddling stocks on the high seas portion of the Grand Banks[127] are two manifestations of this view. However, article 7 of the FSA establishes the principle of compatibility whereby neither group of states takes precedence. Rather, measures established by RFMOs for the high seas and by coastal states for within their EEZs are to be compatible. Unfortunately, although article 7 does list a number of factors that are to be taken into account in determining compatibility, no guidance exists on precisely whose measures are to be compatible with whose.[128] Resolution of the issue of compatibility is left to be dealt with by the dispute settlement provisions of the FSA an approach which has not yet been tested. In any event, it is clear that while RFMOs may consider coastal state catches when reaching decision on allocation, they cannot, without the agreement of the relevant state, fetter coastal states' sovereign rights to exploit the living resources within their EEZs.

2.6 How to allocate?

A final set of principles relate to the question of how, or in what manner, RFMOs should allocate fishing opportunities. Neither the LOSC nor the FSA provide any specific principle to guide allocation processes. Rather, the FSA merely calls upon members of RFMOs "to agree, as appropriate, on participatory rights such as allocations of allowable catch or level of fishing effort".[129] The FSA does set out a number of criteria that are relevant to the allocation issue although no indication is given of the relative weight of these criteria. Nevertheless, these criteria reflect a number of underlying legal principles including the precautionary principle, the ecosystem approach, the principles of non-discrimination and fairness, and the principle of recognition of the

[124] See M. A. Orellana. 2002. "The Swordfish Dispute between the EU and Chile at the ITLOS and the WTO". Nordic Journal of International Law. 71:55-81.

[125] R. Rayfuse. 2003. "Canada and Regional Fisheries Organisation: Implementing the UN Fish Stocks Agreement". Ocean Development and International Law.34:216.

[126] F. O. Vicuña. 1992. "'The Presential Sea': Defining Coastal States' Special Interests in High Seas Fisheries and Other Activities". German Yearbook of International Law. 35:264-331.

[127] Canada, Department of Fisheries and Oceans Canada, Report of the Roundtable on Improving the Management of Straddling Fish Stocks, 11 April 2003, available at http://www.dfo-mpo.gc.ca/media/backgrou/2003/hq-ac18a_e.htm.

[128] A. O. Elferink. 2001. "The Determination of Compatible Conservation and Management Measures for Straddling and Highly Migratory Fish Stocks". Max Plank Yearbook of United Nations Law. 5:551-607.

[129] FSA Art 10(b).

special requirements of developing states.

While argument persists over whether the precautionary principle is a principle or an approach, the precautionary approach is one of the 'general principles' enunciated in article 5 of the FSA. The details of the application of the precautionary approach is set out in article 6 which, at the risk of oversimplification, requires RFMOs to be more careful or cautious in their allocation decisions where information is uncertain, unreliable or inadequate. A number of RFMOs have been working to introduce the concept of precaution into their management decisions. However, particularly where considerable IUU fishing activity is occurring, this may require RFMOs to revisit and revise downward existing allocations. As experience in the CCSBT and other RFMOs has demonstrated, however, members are extremely loathe to reduce their allocations, even in the face of conclusive scientific evidence of the need to do so.

Article 5 of the FSA also requires the adoption of an ecosystem approach which protects not only the targeted stocks, but non-target associated and dependent species as well as the biodiversity of the marine environment as a whole. However, as experience in CCAMLR has shown, implementing an ecosystem approach is a difficult and complex matter. Moreover, in implementing an ecosystem approach RFMOs may again need either to revise downward allocations of targeted stocks or otherwise restrict the manner in which fishing activities are carried out.

The fundamental principles of non-discrimination and fairness also apply in the allocation context, although their successful implementation may be far from assured. In the quest for compatibility or high seas and EEZ measures, Article 7(2)(d) of the FSA requires states to consider the biological unity and other biological characteristics of stocks and the relationships between the distribution of the stocks, the fisheries and the geographical particularities of the region concerned including the extent to which the stocks occur and are fished in areas under national jurisdiction. Sub-paragraph (e) requires states to take into account the dependence of coastal states and high seas fishing states on the stocks concerned. Allocations which fail to consider any of these aspects will result in unfairness either to the coastal or the fishing states which in turn will be evidence of discrimination against one or the other.

The FSA is particularly concerned with how RFMOs should allocate participatory rights to new members. Article 11 sets out a non-exhaustive list of criteria to be considered including: the status of stocks and level of current fishing effort; the respective interests, fishing patterns and fishing practices of new and existing members; the respective contribution of new and existing members to the collection and provision of data and conduct of scientific research on the stocks; the needs of coastal communities which are dependant mainly on fishing for the stocks; the needs of coastal states whose economies are overwhelmingly dependent on the exploitation of living marine resources; and the interests of developing states in the region in whose areas of national jurisdiction the stocks also occur. Nevertheless, even a cursory glance at these criteria seems to indicate that they are weighted in favour of existing fishing effort and existing compliance with RFMO regimes to which states may not even be party. Moreover, as Molenaar notes, these criteria relate not only to situations where fishing opportunities are to be allocated but may also encompass situations where no allocations are made at all.[130] In this case there will be little incentive for new entrants to join RFMOs. Thus, these criteria neither necessarily discourage unregulated fishing, nor compel fairness and non-discrimination in the allocation of fishing opportunities.

This may be somewhat ameliorated in the case of developing states by the operation of articles 24 and 25 of the FSA which call for recognition of the special requirements of developing states and set out the forms of cooperation by which assistance to meet those special requirements is to be provided. However, while FSA parties are to assist

[130] Molenaar, supra note 17, p468.

developing states to develop their own fisheries for straddling and highly migratory fish stocks, to enable them to participate in high seas fisheries, and to facilitate their participation in RFMOs, cooperation for these purposes is to take the form of financial assistance, human resources development, technical assistance, transfer of technology through joint venture arrangements, and advisory and consultative services. Nothing in the FSA gives developing states a prima facie right to an allocation of high seas fishing opportunities. Yet it will be recalled that all states have the right for their vessels to fish on the high seas.

In an undersubscribed or unregulated fishery new entrant developing states will likely have little difficulty obtaining an allocation. However, in many RFMOs the most lucrative fisheries are already fully or over-subscribed. Thus, the only way developing states or other new entrants might receive an allocation is if existing members of an RFMO either willingly reduce their own allocations, a level of altruism not yet evidenced by members of RFMOs, or agree to possibly unsustainable capacity increases. One alternative, which has been adopted in NAFO, is to provide new entrants with allocations in respect of new and unallocated fisheries only.[131] Other RFMOs provide allocations to new entrants from 'others quotas' or that portion of the allocation that is set aside to account for fishing by cooperating non-members. Another approach is found in the Fleet Capacity Resolution[132] adopted by the Inter-American Tropical Tuna Commission (IATTC) which only allows for allocation of fishing opportunities to new entrants where they make arrangements to replace a vessel already listed on the IATTC Vessel Register. The overall effect of all this is, however, that neither articles 24 and 25, nor these allocation approaches, necessarily discourage unregulated fishing or encourage developing countries to join RFMOs. Instead, they lead to the perception that the 'haves' will continue to have (albeit it often in continually decreasing amounts) and the 'have nots' will continue to be left to settle for the leftovers.[133]

Of course the issues of allocation criteria and new entrants are not co-extensive. Allocating fishing opportunities as between members is an important – and almost always contentious – aspect of RFMO activity. Despite continuing scientific advice of the need to limit catches of bigeye tuna, the IOTC has not yet been able to adopt any system of allocation of fishing effort. Rather it has merely called on members to limit their catches to "recent level of catch reported by the Scientific Committee" and has determined that at its next meeting in 2006 it will establish interim catch levels for cooperating non-members.[134] The IATTC has taken a different approach by attempting to limit fleet capacity.[135]

Some RFMOs are now moving to adopt detailed allocation criteria. The ICCAT Criteria for the Allocation of Fishing Possibilities,[136] adopted in 2001, are the most comprehensive example to date and apply to all stocks when allocated by ICCAT. Included are criteria relating to: past/present fishing activity; the status of the stocks; the status of the qualifying participant states; and the record of compliance or cooperation by participant states. Also included is a list of nine conditions for applying the criteria including the requirement that they be applied in a fair and equitable manner with the goal of ensuring opportunities for all qualifying participants and that they should be applied in a manner that encourages cooperating non-members to become members where they are eligible to do so. Interestingly, however, no qualifying participant

[131] NAFO Resolution to Guide the Expectations of Future New Members with Regard to Fishing Opportunities within the NAFO Regulatory Area, supra note 20.

[132] Resolution on Capacity of the Tuna Fleet Operating in the Eastern Pacific Ocean, June 2002.

[133] R. Rayfuse. 2004. "The Challenge of Sustainable Fisheries" in Nico Schrijver and Friedl Weiss (eds) International Law and Sustainable Development, Principles and Practice (Brill). p487.

[134] IOTC Resolution 05/01 on Conservation and Management Measures for Bigeye Tuna.

[135] IATTC Resolution on Fleet Capacity of the Tuna Fleet Operating in the Eastern Pacific Ocean, June 2002.

[136] ICCAT Recommendation 01-25.

shall trade or sell its quota allocation or any part thereof. The approach proposed by Republic of Korea in the CCSBT would not work in ICCAT. After a rather rocky start to its implementation, which resulted in the Commission failing to reach agreement on any allocations in 2001, the allocation process appears to have improved to the point that in 2005 Taiwan Province of China's allocation was significantly reduced due to its continuing failure to comply with Commission measures and its involvement in IUU fishing, both conditions to be considered in applying the allocation criteria.

In contrast, the NAFO Draft Guidelines for the future allocation of fishing opportunities for the stocks not currently allocated[137] set out four criteria only: historical fishing in accordance with NAFO rules during a representative reference period; contribution to research and data collection on the stock concerned; needs of coastal communities which are dependent on fishing for the stocks concerned; and/or contribution to the NAFO Conservation and Enforcement Measures. Disputes over allocation in NAFO are legend and it is not clear how these criteria will assist in resolving them, or the problem of unregulated fishing in general. Similarly, while the CCAMLR approach of 'olympic' style fisheries overcomes the problem of disputes over allocations between members it does not entirely, at least in the absence of an effective enforcement regime, resolve the problem of IUU fishing.

3. RECONCEPTUALIZING THE LEGAL PRINCIPLES RELEVANT TO REGIONAL ALLOCATION ISSUES

The challenge of allocation has elsewhere been stated to be to ensure that "each and every participant anticipates receiving long-term benefits from the cooperatively managed fishery that are at least equal to the long-term benefits it would expect to receive in the absence of collaboration".[138] The question is what legal principles might better assist RFMOs to meet this goal?

First, the principle of freedom of fishing could be retired from the pantheon of fundamental principles. Indeed, the continued articulation of the principle is both inaccurate and misleading, if not downright disingenuous. As noted above, the 'freedom' has long been subject to a developing range of limitations and exceptions including the obligation to cooperate in respect of the conservation and management of high seas fish stocks, through the establishment, where appropriate, of RFMOs. The corollary of this is that where a state fails in its duty to cooperate it forfeits the right for its nationals to participate in the 'freedom' of fishing. While the content of the obligation to cooperate is still developing it arguably now involves, at a minimum, the obligation to either agree to abide by the measures adopted by RFMOs or refrain from fishing. States who authorise or otherwise permit their vessels to fish in contravention of RFMO measures, or who fail to restrain their vessels from engaging in IUU fishing, or to take effective action against any of their vessels that have engaged in IUU fishing are in breach of their duty and forfeit the right for their nationals to fish. Other states may then take countermeasures against the breaching state which might even include the arrest of the vessels concerned.

Next, the principle of exclusivity of flag state jurisdiction could also be retired. Like the freedom of fishing, flag state jurisdiction is not, in fact, exclusive. Rather, it is only primary, and is conditioned by reference to a number of exceptions. Where a flag state fails to meet its responsibilities a secondary jurisdiction over its vessels may be vested in non-flag states[139] which might then take enforcement action against recalcitrant vessels. Moreover, the principle of flag state jurisdiction itself could be rejected or

[137] NAFO: Meeting Proceedings of the General Council and the Fisheries Commission for 2002/2003, Annex 11 at 172-173.

[138] FAO. 2002. Report of the Norway-FAO Expert Consultation on the Management of Shared Fish Stocks, FAO Fisheries Report No. 695. Rome, FAO. p8.

[139] For a comprehensive analysis of this issue see Rayfuse, supra note 9.

modified with the power to flag residing in the RFMO. A less drastic approach would be to require 'dual-flagging' on high seas fishing vessels. In either case, only vessels authorized by the RFMO and flying its flag would be entitled to engage in a high seas fishery. All other vessels would be prima facie IUU vessels and subject to arrest or other measures either by the enforcement services of the RFMO or by any other state.

Next, the institutionalization of RFMOs could be further strengthened by acceptance that RFMOs act as the custodians of all high seas fisheries on behalf of the international community as a whole. To that end RFMOs could be given the power not only of binding regulation and allocation in consultation with coastal states in whose waters the relevant stocks are also found, but could also possess the machinery necessary to enforce that regulation. A fair, equitable, and non-discriminatory allocation strategy along these lines might then involve an RFMO setting overall catch limits for species and auctioning off quotas to commercial operators – as opposed to states. The proceeds of the auction would then go to fund the operation of the RFMO, its scientific research and its enforcement services which could also be utilized by coastal states seeking to ensure that high seas operators are not operating illegally in their waters. In other words, the solution to both the allocation and IUU fishing issues might lie in the development of individual property rights in high seas fisheries which are allocated, overseen and enforced by RFMOs.

4. CONCLUSION

It is acknowledged that the above suggestions are controversial and not fully developed. However, it is often said that the question of allocation cannot be dealt with until the issue of IUU fishing is resolved. Yet, perhaps what is needed is a reconceptualization of the problem. In other words, perhaps the solution to IUU fishing lies in finding a new legal paradigm in which 'allocation' takes place. Radical, lateral and controversial thinking may be what is needed to awake in our minds a "consciousness that is attuned to the pulsation of Reality". A metaphorical Zen-like 'slap in the face' may be what is needed to hasten the attainment of enlightenment in the context of regional allocation issues.

Allocation issues in fisheries management

Dr Wendy Craik
Chief Executive
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Australia

Thanks very much, Peter, I'm gathering it's Peter from your voice, and thank you for the welcome. Firstly, my apologies that I can't be with you today, I was actually really looking forward to catching up with my fisheries colleagues, and the program that you've managed to put together looks really interesting, so I really apologize that I can't be there in person, but last week I was struck down by a virus, and I thought it was probably important to actually try to get rid of it, so I hope this presentation works[140] with the slides being controlled by someone over there and I just provide the voice-over.

Now, when Peter first asked me to talk, he reflected on the fact that I'd worked in both fisheries and water, and asked me to make some remarks on sharing publicly-owned resources from my experience in both those areas. I'd just have to say, my experience in the water area is a bit less than my experience in fisheries, but it's certainly been a steep learning curve in the last 18 months or so.

1. INTRODUCTION

So, if we can move on from the first slide on to – which I assume is on the screen now – on to the second slide, "Sharing the Resource", I thought it was worth starting with this quote which is attributed to Winston Churchill, which indicates that in the very early days of water management, there were some very interesting views in place:

> *"...every last drop of water which drains into the whole valley of the Nile shall be equally and amicably divided among the river people, and the Nile itself shall perish gloriously and never reach the sea".*

It's pretty clear looking at this quote from Churchill that he didn't think much of freshwater environments, or freshwater fish, or anything about the fish that had to move up or down stream, or prawns to breed. But, in a sense, I suppose, it shows that the early views of water were nearly as optimistic as the early views of fish.

If we can move on to the next slide, I found a quote from T. H. Huxley[141] which really suggests that fisheries management was a waste of time:

> *"I believe, then, that the cod fishery, the herring fishery, the pilchard fishery, the mackerel fishery, and probably all the great sea fisheries, are inexhaustible; that is to say, that nothing we do seriously affects the number of the fish. And any attempt to regulate these fisheries seems consequently, from the nature of the case, to be useless."*

Now, I suppose there are some who still agree with that quote – the fact that it's a waste of time – but I think in the last hundred years in both the areas of fisheries and water we've certainly made significant progress. I think we'd all agree – those of us

[140] Presentation can be found at: http://www.fishallocation.com/.
[141] T. H. Huxley. International Fisheries Exhibition. 1883.

who have been involved in the management of fisheries and water – that that progress has not been without some stumbling along the way.

If we could go to the next slide, headed "Publicly owned resources", I'm not going to give you a long talk about the tragedy of the commons, but I guess that's the underlying issue that we're dealing with in terms of managing publicly-owned resources, when no one actually owns the fish, and no one has the responsibility to look after it. And because they're large and sometimes fall into finite resources, and monitoring the impacts on them is costly and difficult, our responsiveness perhaps is not what it should be. And certainly, I think we're generally slow to act, and I think history has shown us that we're generally slow to react even when a problem is first perceived.

If we can move on to the next slide, headed "Fish and water". As I mentioned, I'm going to compare fish and water today, but I'm actually going to do that using specific examples: the first one being in terms of fisheries, Commonwealth fisheries; and; in terms of water, the Murray-Darling Basin Commission approach to water. I've limited it to those two, simply because I know most about them, and I'm certain there will be differences in other fisheries and other water environments. But I think they really illustrate the main points that I want to make well enough. I want to cover today the evolution of management, the features of management, parallels and differences, and try to suggest what we might have learned, and make some remarks about the future.

2. FISHERIES

We move on to "Fisheries". Much of what I say now will be familiar to many of you, and a quick run-through of pre-1991 Commonwealth fisheries management, and this came from the DAFF[142] website, so it's not my view of history. There was a 'command and control' approach to Commonwealth fisheries management, the Australian Fisheries Service was located in the Federal Department of Primary Industries; there was little consultation with the industry or with other players, like NGOs. Fisheries management was based on some conservation input controls, and I think everyone would agree there was excess capacity, there was full exploitation of fisheries or overexploitation in many fisheries, and as a result, poor economic performance. And in 1988, the brave new world came into being, with the *New Directions* policy statement.

Now, after 1991, the institutions that shape Commonwealth fisheries management: you obviously had the Offshore Constitutional Settlement that had been negotiated over a number of years, and distinguished Commonwealth and state fisheries, although there are still some areas unresolved many years later, and some areas, I guess, that people would wish had been resolved in different ways. You have the federal department, the Department of Primary Industry, the federal portfolio department determining policy; you have the Australian Fisheries Management Authority (AFMA) responsible for implementing management; the Fisheries Research and Development Corporation (FRDC), responsible for a large part of fisheries research and development in Commonwealth fisheries; and, in more recent times, you have the Federal Department of Environment and non-government conservation bodies involved as well, in management of these fisheries. The objectives of fisheries management: ecological sustainability and economic efficiency.

Now, in fisheries management, there are fisheries management plans in place, statutory fishing rights are or will be in place in all Commonwealth fisheries, total allowable catches are set in each fishery, generally for a single species, and they're set on an annual basis; you have management and budget committees in place in each fishery, and they're comprised of government, industry, and environmental people, and AFMA

[142] Department of Agriculture, Fisheries and Forestry, Government of Australia.

has a statutory authority, a board which has government, industry, science, and various other people that reports to the federal minister of fisheries, who I believe, is, or has been, with you today.

Each fishery management plan has an objective and covers things like areas, gears and timing. As I mentioned, the total allowable catch generally is set on an annual basis for each species, and based on catch history, stock status, stock interactions and market factors. All the things you'd expect, and anything else that's relevant. And in the setting of these total allowable catch each year, scientists are involved, fishers are involved, there are conservation groups involved, management advisory committees have a major role in the setting of those total allowable catches.

Moving on to the next slide, number 11 "Fisheries: management". There are statutory access entitlements, as I've mentioned, and they provide each owner with a share, a predetermined share, of whatever the total allowable catch is, so, while the share doesn't change, the annual number of kilos that's in that share may well change. The entitlements are tradable within the fishery; there are limited carryover arrangements in place; and as well, of course, there are bycatch arrangements in place for fisheries, which is all about dealing with the impact of the fisheries on the environment, beyond the target stocks – that'll deal with things like gear and timing.

Moving on to the next slide, which is headed, "Fisheries: issues". These are the issues, as I understand it, that fisheries, Commonwealth fisheries, are facing today, and these aren't either unique to Commonwealth fisheries, or they're not unique to the current time. The increasing efficiency of users, of fishers, is obviously an issue that is a challenge how to deal with in any kind of a reasonable way. Overfishing of stocks, a recent Bureau of Rural Sciences (BRS) report that suggested 29 stocks were overfished or fully exploited, but I should point out, that the northern prawn fishery, the brown tiger prawn, has improved its status from being overfished, which is great news.

The cost of management and monitoring sometimes exceeds the gross value of production of a fishery and, of course, one of the difficulties is, you're out at sea, and as everybody knows, the cost of being out at sea go up in getting independently verified data, always costly. Illegal fishing in the Australian fishing zone is a real issue for this country. I read that 39 vessels have been seized in the northern area this year, and of course there's the overfishing, or the illegal fishing, sorry, in the Antarctic, and how we can deal with that in a complete way is a real challenge. Now, how the strategy frameworks have been put in a place, as a couple fisheries have had them in, but this is all about having agreed targets and limit reference points and agreed decision rules, and all fisheries will have this by 2008, or at least a proposal.

And, of course, recently, last year, the federal minister of fisheries at the time amassed a $220 million dollar adjustment program, about two-thirds the annual value of the gross total production of the fishery. So, not withstanding the fishery management arrangements that are in place, the minister commented that we had too many boats chasing too few fish in our fisheries. Now, these adjustment plans were accompanied by significant reductions in the total allowable catch, so, even though we have all these management arrangements in place, we still find the need for adjustment packages.

3. WATER

Moving on to the next slide, which is headed, "Water", and then the next slide giving you a comparison between fisheries and water.

Before 1992, and obviously after, it's really important to understand the role of the Constitution, Clause 100 of the Constitution in relation to water management in this country. And Clause 100 says that the Commonwealth shall not, by any law or regulation of trade or commerce, abridge the right of the state or of the residence they're in to the reasonable use of the river for conservation or irrigation. In other words,

water is the responsibility of the states, and that the only way that the Commonwealth can influence that is generally by funding.

Now in 1915, you wouldn't quite right about here, but you're close. The first idea for some kind of agreement came into being in 1893, so it actually took 22 years to actually come to fruition in the River Murray Water Agreement, in 1915, signed by those four jurisdictions. In it, it had some major provisions. It had some agreed water-sharing principles, where, under which the upper states, Victoria and New South Wales, agreed to share the water equally at Albury - all water above Albury they share equally - and South Australia gets a predetermined share every year. There's an agreed minimum monthly share, and an agreed annual share that South Australia gets, and all the rest of the water is generally available for the taking or not, and goes down the river.

So, as well as water-sharing principles, there was agreement about infrastructure – so, building dams and locks and gears, the focus was very much on the river itself, not the surrounds, but the river itself and the water in the river. In 1987, after being in place for a fair period of the time, amendments were made to the agreement which really broadened the coverage of the agreement to include more about the basin and impacts on shared water resources.

Next slide, please: "Water: history post-1992". The 1992 Murray-Darling Basin Agreement was signed, which actually reflected the 1987 agreements, was still very River Murray water focused with broader based add-ons. It's worth pointing out that the agreement is reflected in the legislation of each participating jurisdiction in the commission, so that when you have things going through numbers of parliaments, it takes a while to get changes in place. Now the original water sharing rules were agreed, and the objective of the agreement is to promote and coordinate planning and management of equitable and sustainable use of land, water, and other resources. By 1998, Queensland and the ACT had also signed, so all the jurisdictions that could have an interest in the Commission are now signed up to the agreement.

Next slide, please, headed "Water: management" listing the institutions that determine water management within the Murray-Darling basin. Firstly, you've got the Constitution. Then you've got the Murray-Darling Basin Agreement that determines what the Murray-Darling Basin Commission does in terms of provision of water to the states: they give shares of water to the states, notify the states when shares of water are available, and it's the states that make the allocations to the irrigation organizations or irrigators, or irrigation organizations do it then to irrigators.

Of course in more recent times, we've had the COAG water reform agenda, the National Competition Policy (brought in 1994), and the National Water Initiative agreed in 2004. Both of those are really about having a more efficient and effective and environmentally sustainable water industry in this country.

Next slide, please. Just to give you an idea of the nature of the sort of complexity that we're dealing with in this single basin. Now, I know it's a large basin, but it's still a single basin. At the top of the next slide (headed "State management"), you can see that the top lines give you the nature of the water organizations in each of the main jurisdictions. From there you go from statutory authorities to private irrigation companies, to trusts, to government owned corporations.

So, you can see there's a real difference. In some cases you get individual irrigated water rights; elsewhere, the irrigated shareholders of the companies don't actually get the entitlement like a statutory right, but they get a share in the company which, of course, then relates to their water rights, but it's a slightly different instrument. So there is a lot of variation. Of course, most of the states are going through legislative change because of the National Water Initiative, and most of them – all of them – have some kind of regional plan or are putting regional water plans in place.

3.1 Water management

Next slide, please, headed "Water: management". How is the water actually managed? Well, you have the water sharing principles that are managed, and in 1995, a major initiative was the cap on surface, on valley surface water diversions - in other words, on how much water is taken out of the river.

The cap puts a maximum limit that applies in perpetuity on diversions, and that maximum limit is set at 1993-1994 levels of development of that valley. And those caps are put on the Kiewa River Valley. Queensland and ACT have yet to determine their caps. The cap is climate adjusted each year. It relates only to river water (and that's important to know - it doesn't relate to ground water or what's in farm dams, generally). It's also independently ordered each year. And at the time it was put in place it was not determined whether the levels of diversions, those cap levels, are actually environmentally sustainable.

Moving on to the next slide, also headed "Water: management". We have the annually agreed share provided to the states under the water-sharing principles. Now, the states get a sort of progressive advice as to what water is going to be available as more water becomes available in dams, and we, the Commission, advise states as to the availability of water, and that depends to an extent on rainfall and outlook.

In the states, the allocations to irrigators, again, depend, of course, on what's available - rain fall and outlook - and it's all limited by the cap. Again, these allocations to irrigators and how much irrigators actually get are limited by the kind of entitlement that that they hold. Because whereas there might be one kind of statutory entitlement in fisheries, each state generally has different kinds of entitlements: in New South Wales you have high security entitlements and you have general security entitlements; in Victoria you have high security and sales water; and in South Australia you have high security, and within those, you have a range different products depending on which river you're in and things. So, the kind of entitlement you have depends on the amount of water you're going to get at any one time, but it's always within the cap. And of course in recent years with the drought, the amount, the volume that the irrigators have been getting has been low. For instance, New South Wales general security irrigators have had some of their lowest allocations in 100 years of record.

Moving on, next slide, headed "Water: management", the statutory property rights that are being legislated in each state – as I mentioned, there's a range of products given the nature of the entitlement, - relate to a share of the state's allocation in some way, or the shareholder in the company, but again it varies a bit with the states and this is a generalization. Nonetheless, they're river valley dependent.

One of the processes that has to be gone through at the moment is separating the water rights from the land, and one of the other issues that is also being resolved at the moment is one of the issues in relation to water trading use: a lot of water moves out of one area and ends up in another area for use, and, of course, most people are going to want that water at the same time, but the capacity of the river channel is limited. During the very hot weather at the beginning of this year, we had some challenges and irrigators' demands; we had some challenges in providing the volume of water that was required. There's carryover for New South Wales general security, but no other kind of water entitlement that I'm aware of.

Tradability of water is a bit limited at the moment. Temporary trading, especially with in valleys, has been going on for some considerable time and now adds up to about 10% of total diversions. We had a pilot study going in the late 1990s looking at permanent water trading in high security entitlements below Swan Hill to the Murray Mouth, and of course, the National Water Initiative is focusing very much on broadening trading in permanent water entitlements. You will have seen a fair amount of press on that in recent days, as the date in the National Water Initiative has been

passed, but South Australia and Victoria have agreed to a deal at the moment, and we are busily negotiating arrangements for the basin, the Murray as a whole.

3.2 Water issues

Next slide, "Water issues". Again, one of the issues is the Murray-Darling Basin Agreement, as I've mentioned, is that this is largely a river focused agreement about delivering water with some add-ons. Under the National Water Initiative it has to be amended to make consistent with the National Water Initiative, and probably to bring it up to being a contemporary planning document.

The water-sharing rules that are in the agreement were generally developed for irrigation and communities, and clearly there are some current challenges there that aren't dealt with in the agreement on a long-term basis. One of those is the general capacity issue that I mentioned before, how do we actually deal with that -Who gets what share? Overallocation is an issue a bit like overfishing, and that's what led to things like The Living Murray which is recovering 500 gigaliters of water for the Murray, for the environment, and the National Water Initiative.

Next slide, please, another one headed "Water issues". There are still a lot of issues to sort out in water trade. This is not an easy one given the number of products, the number of states, and the number of areas, and different environments and given the issues that are still being resolved: the rules around temporary versus permanent trade; whether you use an exchange rate (it's a bit like currency exchanges) and is that the sort of message you use? Or, do you, does the water entitlement retain the original attributes of its initial location and do those attributes stay with it wherever it ends up going ("tagging")? There's a bit of a debate on about an exchange rate basis or tagging. Obviously, to move water around because of things like salinity and water logging, environmental clearances are necessary before any trading takes place. Developing all those for the appropriate areas is important, and a bit like when fisheries shut down, all the efforts that have been developed up around that fishery tend to be stranded. What do you do about them, if water moves out of a valley? You've got all the irrigation infrastructure, and who's going to pay for its upkeep? All these issues are still being resolved.

Next slide. A major issue we're starting to deal with now is what are the risks of the shared water resources? In other words, what's going to affect the quality and quantity available in the future?

Clearly one distinct possibility is climate change, with the estimates being quite broad as to what impacts are likely on water availability – some go to 20% less in the next 20 years, the on average is available now. Groundwater extractions have increased in recent years - the number of bores has increased as has what's been taken out of the ground, particularly with the imposition of the cap and the drought in recent years. And there are those who say that a gigaliter of groundwater is equivalent to taking out a gigaliter of river water at some time over the next 50 to 100 years. Farm dams, and how much water is held in farm dams that doesn't actually get into rivers is another issue, and I think the answer is that we don't really have much of an idea.

In terms of bush fires, if the foliage, the vegetation burns down, the water yield generally increases to start because there's nothing sucking up the water in the ground as it runs down the hill. But, over time, you may get a significant drop in water yields as the trees start growing back. And another one is that as irrigators become more efficient, this water sinks back into the ground and returns, or runs off, into the environment. So, while we're encouraging efficiency, on the other hand, it may have what you might regard as a downside in terms of the spill going back into the environment.

Other major issues, again like fisheries, include the cost of monitoring and measurement, the cost and the precision in those areas: cost of monitoring is increasing,

and how do we do it in a cost-effective way; the difficulties of measurements (and some of them generally, historically haven't been as accurate as they might be); and, we're moving now to electronic measurement to get much greater precision.

3.3 Parallels and differences

Next slide, having done a quick canter through fisheries and water and how they're approached – their management is approached – what are the parallels and differences between the two? Well, the parallels as I see them, and that's the next slide, headed "Parallels: fish and water" are: firstly, that both of them have management plans in place, or being put in place; there are some kind of access or property rights in place, or being put in place; they generally relate in some way, direct or indirect, to shares of the resource available in any year; the entitlements are tradable to a certain extent; and, in some cases although you might question the sustainability of extraction, it's based on some information (but perhaps not on as good information as we would like).

Next slide, again more parallels. There are overallocated resources in both water and fish; both of them have associated strategies like the bycatch strategies in fisheries, and in water we have things like the salinity strategy, which is all about dealing with the salt and how we can deal with it as a result of irrigation largely mobilizing salt.

Both of them, both fish and water, have recovery programs in place. There's the adjustment package announced last year for Commonwealth fisheries, and things like The Living Murray recovering 500 gigaliters of environment is in place for the Murray-Darling Basin.

Monitoring and measurement: the cost of monitoring, as I mentioned, is high in both, and there is the issue of how do you do it cost-effectively. The precision of measurement, again, has its challenges in both areas. Increasing user efficiency, of course, is an issue in both resources, and finding ways to deal with it in a way that assists, is helpful for the industries themselves, is a challenge, but much more so in fisheries, in that if users become more efficient in irrigation, generally they expand their area under entitlement under irrigation.

On to the next slide, the differences between fish and water. I think the approach to the extraction limit is slightly different, I think diversions – water diversions – are generally, they're not at 1994 levels, or set at a point in time, then you have an annual level which is at that, or below that level. The TAC is really set annually, there's really no upper limit on it, and it's based on a range of factors. Now, the water diversions are based on a range of factors, too, but I think it's a slightly different approach. There's a total limit on extractions in water, which is the cap, whereas there is none in fisheries, there's no upward total allowable catch, other than what was set each year.

The nature of the entitlements: in water, I think the entitlements are more complex in the sense that you have a much greater variety of entitlements than you do in Commonwealth fisheries.

The kind, and level, of end user involvement, I think, is a bit different in both areas. In fisheries, you have the management advisory committees who are very involved in setting the total allowable catches, for instance, while in water, the end users are involved in developing water sharing plans, a bit like fisheries management plans. They're not involved, in any way, in setting the annual diversions and the annual allocations for water.

The complexity of entitlement differs a bit, and I mentioned that. I think conservation interests are generally a bit more active in or, historically have been more active in, fisheries than in water. I think we're stepping up the conservation interests in waters, these days, but I think the almost institutional involvement in fisheries isn't matched in water yet. I think the view of environment, I think fisheries now, at least their approach is almost entrenched in management arrangements. I think we're moving that way in water, but I think we've got a bit of a way to go.

I think, in terms of risk assignment in water, some of that is spelled out quite clearly in the National Water Initiative – who actually bears the cost if the government change a policy, who bears the cost if it's a national phenomenon – so those things are actually quite clearly spelled out. Whereas in fisheries, while you might get the end result being similar, it's not spelled out anywhere that I'm aware of in terms of policy.

4. WHAT HAVE WE LEARNED?

I think there's no doubt that we're overoptimistic managers for these natural resources. We tend to believe that if we take this action, it's going to work out. We do tend to overallocate our natural resources, and our history would underline that on the other side of the coin, we're not cautious enough. I think, though we're improving. And, I think often we don't have a very good understanding for the reasons for our resource variability or what the scope of it can be, or what the range of that variability can be.

Moving on to the next slide, more of what have we learned, well, clearly, we've managed on history, I think that's inevitable. I think water's a bit luckier, because I can see how much it's rained in any one year, and that helps determine allocations. That makes it a bit easier than fisheries. I think we have a good understanding of sustainable resource requirements: what's precisely required to sustain a fishery, and what's precisely required to sustain a river. I think there's plenty of scope for work there. Independent monitoring programs found necessary, but they're incredibly costly, and we really do need to find better ways to handle how we deal with that issue. And I think there's no doubt that statistically proving cause and effect is very difficult and often there's a reluctance to act, and this is understandable, too, until you can actually demonstrate that link – but the danger is that we keep monitoring precisely until we get irrevocable information or irrefutable information on usually, what turns out to be the decline of a particular resource, but it's very nicely measured.

Moving on to the next slide, "What have we learned". Now, this slide might be controversial, but I thought it was food for thought. This came from a Canadian paper[143] relating to Regional Fisheries Management Councils in the United States, which suggested that there are a lot of reasons for modern fisheries management failing, if you accept that it's failed. The author proffered up this reason, that "the most fundamental reason might be the overwhelming dominance of extractive interests in participatory decision-making venues", and I'm just putting it up as food for thought.

Moving on to the next slide, "What have we learned", I don't think we test our management assumptions often much before we implement them, we make an assumption that it's going to work, that it'll to be better than the other management option in place, but often we don't monitor those assumptions very well. Inevitably, we have inertia in our institutional arrangements, and, again, understandably there's often political caution to act in any major way, because people's livelihoods are going to be affected, so that's not at all surprising.

Moving on to the next slides about "The future". We've got all those management challenges to deal with in the future, but I think the other challenge we're going to have to find a way to deal with is climate change, because inevitably that's going to affect not only water, but fisheries as well. We need to make sure that we have budgets that actually pick up the whole system. Fisheries is further along the way in dealing with that than water is, I think, in terms of taking a holistic approach. We don't include and we don't prepare water budgets with farm dams, ground water, all those sorts of things, and we don't have a good idea, say, of total water taken out of the system each year.

In terms of interactions between different fisheries, different fishes, and different parts of the environment, I think getting a handle on those is difficult both in fisheries

[143] Okey, T.A. 2002. Membership of the eight Regional Fishery Management Councils in the United States: are special interests over-represented? Fisheries Centre, University of British Columbia.

and in water. We're trying to look at the interactions between the various risks to available water resources, because they're known to interact, but that's a challenge.

Community views are something that's really going to guide the development of where both fisheries and water go in the future and where that's going to be. I'm not sure that we can always predict that.

And, on to the last slide, increasing user efficiency is clearly something that we do need to deal with, along with how we find some way of managing that so that it's actually an autonomous adjustment.

Illegal extractions clearly are a big issue, particularly in fisheries. And when you ask people about it in water they say, "I'm not sure if anyone's actually measured it" but I think we're seeing more of that with some if this more electronic measurement occurring.

And institutional arrangements: do we need to do anything about them? I don't have a fixed view on it, but do we need to make them more rigid or more flexible? Do we need some kind of national capacity to address fisheries issues like we have in the National Water Commission? I don't know, but I just raise these for thoughts.

So there you have it, my view on a bit of comparison in a nutshell fisheries and water and the issues related to allocations and sharing. Thank you very much for listening.

THEME 2
Allocations across sectors

Allocation of catches among fishing sectors: opportunities for policy development

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1. INTRODUCTION

The theme of this conference - the allocation of fish resources - refers to a pervasive challenge in fisheries management. Traditionally, it has also been a contentious subject, and for centuries it has preoccupied fishers and fisheries managers. I have been asked to comment on a narrow slice of the broad allocation problem; that is, the question of allocating catches among the distinct groups or sectors of fishers that often share access to a fishery.

In preparing this paper I found that although there is now a wealth of literature on fisheries allocation issues, there is not much on allocation among sectors. But I also found that some new problems associated with sectoral allocations are emerging, and there is growing interest in solutions. Devoting a session of the conference to this subject is timely.

To introduce this subject, I thought it would be most useful to begin with a brief outline of the issue of intersectoral allocation and the arrangements fishing nations have usually adopted to deal with it. I will suggest that the reason why this is so much more onerous an issue in fisheries than it is in the management of other resources is not because fish are common property but because of the way governments grant rights to the harvest. Then I will turn to recent innovations in fishing rights, notably individual quotas, some new pressures these are putting on sectoral allocation arrangements, and opportunities to improve them. Throughout, I want to emphasize the link between the form of fishing rights held by fishers and their ability to manage their fisheries, and draw attention to policies that will enable self governance.

2. FISHING SECTORS AND INTERSECTORAL ALLOCATION

I do not intend to focus my remarks on any particular country but, to begin, I want to illustrate how my discussion fits into the general issue of allocation with reference to a fishery I know quite well — Canada's Pacific salmon fishery. This fishery is based on five species of salmon and hundreds of separate stocks that sweep down from the northeast Pacific along the coast of British Columbia on their way to spawn in their natal rivers and streams.

Each year, with only meager advance information about the abundance of the stocks, fisheries managers plan fishing operations to achieve a number of allocation targets. First, they allocate the stock between the escapement needed to sustain the resource and the total allowable catch. The allowable catch is then allocated between Canada and the United States according to a formula prescribed in a treaty between

the two countries. Next, from Canada's allocation, the managers subtract the estimated requirements of the aboriginal 'food fishery'. The remainder is allocated between the recreational and commercial fisheries. The commercial allowable catch is then allocated among the three sectors of the commercial fishing fleet — the seine, gillnet and troll sectors — according to established policies.

Finally, these allocations are broken down among the several species of salmon and distributed among several fishing areas, to provide a 'target' allocation for each gear sector in each fishing area.

As the salmon approach, information accumulates about the size of the runs, and estimates are made of the potential catches for each sector in each area. The managers must regulate fishing to allocate the fish among all the competing demands on them promptly and progressively as the salmon pass through a succession of fishing areas.

To complicate matters further, the order of priority assigned to these demands is exactly opposite to the order in which the fish pass through the fisheries. First, the stocks pass through commercial and recreational fishers, mainly at sea; but these are the Department of Fisheries' lowest priority. A higher priority, a constitutional requirement, is to provide for aboriginal catches for food and cultural purposes, mostly in rivers and estuaries. And its top priority, prescribed by statute, is to ensure enough spawners of each stock escape through the fisheries and reach their spawning grounds in the headwaters of rivers and tributaries. So managers must plan in reverse, providing for each of the main fishing sectors in anticipation of higher priority demands on the fish further along their migration path.

This allocation procedure is admittedly an extreme example of the challenge faced by policy-makers and fisheries managers, but it illustrates a number of general issues that I refer to later. One is that the task of allocating stocks can arise at several levels, from allocations among individual fishers to allocations among nations, both of which are subjects of other sessions at this conference. Our session is concerned with allocation among sectors, which I define as separately identifiable, and usually separately managed, groups of fishers sharing the catch in a fishery.

A second observation is that sectors are identified in a variety of ways. Some are distinguished by the gear they use, such as a seine sector and a gillnet sector that share the catch. Sometimes sectors are identified by where they fish, such as an inshore sector and an offshore sector. Others are distinguished by their purpose in fishing, such as the commercial, recreational and aboriginal sectors. The task of allocating among commercial and non-commercial sectors raises particularly challenging legal, social and practical questions.

Third, sectors are often subdivided into sub-sectors. A commercial fleet may be divided into gear sectors. The recreational sector may consist of a commercial charter-boat sector and an independent fisher sector. Moreover, a sector is often split into areas or management units. And, as my salmon example illustrates, these various sub-sectors may call for separate allocations.

Fourth, allocation policies rest on a variety of policy instruments — constitutional rights, statute law, treaties and administrative policies and practices.

Fifth, allocations among sectors vary widely in terms of their specificity, from one extreme of no deliberate allocations at all between competing sectors, to a specific number or weight of fish at the other. Intermediate arrangements include a general priority assigned to one sector over another, the 'target' shares I referred to in the salmon fishery which are not binding on either the fishers or the managers, and percentage entitlements for each sector.

The important point for this discussion is that sectoral allocations are often loosely defined and lack a secure legal or institutional foundation, which makes the rights of fishers more uncertain. Later, I draw attention to commercial fishers' individual quotas,

which often give their holders a secure share of the commercial allocation. But where they share the catch with non-commercial fishers and the allocation between them is not defined, the security of their individual quotas is undermined.

The salmon example also illustrates certain difficulties governments face in allocating catches among sectors. A major constraint is the differing legal foundation for claims on the catch among sectors. Typically, aboriginal and treaty rights are accorded some priority. This, and pressure from all fishing groups to protect their historical patterns of use, constrain managers' scope for reallocating catches among sectors.

Another complexity, where individual fishers' entitlements are not quantified, is that managers cannot directly control the sector's catch. Under traditional open access or limited licensing regimes, fishers have the right to as many fish as they can catch. To implement allocations, governments must resort to manipulation of fishing effort through restrictions on fishing times, places and gear. This makes it difficult to precisely achieve allocations. It also aggravates the politicization and contentiousness of allocation decisions, and the likelihood that they will not reflect any consistent economic or other criteria.

Finally, fishing sectors benefit in different ways from the fish they harvest and so value them differently. Across the commercial, recreational and aboriginal sectors there is no common denominator for the value of fish and no way of comparing the values of fish caught in the various sectors. This makes allocation difficult if the objective is to allocate the fish among sectors in order to realize the highest possible value.

This is not to say that the objective of fisheries management should necessarily be to maximize the value of the catch; other social and legal considerations may call for priority in managers' decisions. But economic benefit is usually at least one of the objectives of fisheries policy. For the purposes of this discussion I will assume that the policy objective is to maximize the value realized from the resource, bearing in mind that the economic benefits generated, especially in non-commercial fisheries, are often difficult to measure.

3. ALLOCATION AND THE EVOLUTION OF FISHING RIGHTS

The task of allocating catches in a fishery is inextricably linked to the form of fishing rights held by those who fish. To understand the opportunities for improving allocation arrangements it is helpful to bear in mind the way fishing rights have been changing and are likely to change further.

My colleague at the University of British Columbia, Anthony Scott, has traced the origin and development of fishing rights in England and other western countries (Scott 2004). A major turning point was the signing of the Magna Carta in 1215. At that time most fisheries were in rivers and estuaries, involving fixed gear such as weirs and traps attached to stream banks and beaches. Consistent with this link to the land, rights to fisheries were held by the owner of the bordering land. Landowners became upset when King John of England began overriding their property by granting fishing rights to outsiders. So the barons inserted a clause in the Magna Carta which committed the king to desist from granting exclusive fishing rights in the Thames and other rivers and, with drawn swords at Runnymede, persuaded him to agree.

Gradually, the courts expanded this to mean that neither the king nor anyone else could grant exclusive fishing rights to anyone in any tidal waters. Therefore no one could hold exclusive rights or exclude anyone else from fishing, which led to the doctrine of a general public right to fish in tidal waters.

Two other legal concepts contributed to the demise of proprietary interests in fisheries. One was the ancient 'rule of capture', which held that no one could own wild animals or fish until they were caught. The other was the doctrine of the freedom of the seas articulated by the Dutch jurist Hugo Grotius in 1609, which meant that no one, and no nation, could own the high sea or restrict anyone from fishing.

These three legal principles — the public right to fish, the law of capture, and the freedom of the sea — together left almost no scope for property rights in marine fisheries.

For centuries there appeared to be no need to ration access to ocean fisheries because they were believed to be inexhaustible. It was not until the 20th century, with convincing evidence of decline of heavily fished stocks, that the threat of overfishing was widely acknowledged.

However, although governments had lost the power to grant fisheries as property, they still had the power to regulate fishing, and the second half of the 20th century saw an explosion of regulatory activity, mostly directed toward protecting stocks from overfishing by burgeoning fishing fleets and free-for-all fishing pressure.

Some of the new regulations changed the allocation process, notably the limitation of fishing licenses which spread quickly through western fishing nations in the 1970s to help control the overexpansion of fishing fleets and excessive fishing pressure. Once licenses were limited, license holders, collectively, held an exclusive right to the catch. The licenses took on a market value, and the allocation of rights of access began to be influenced by market transfers of licenses. But governments still had no direct way of allocating catches among individual fishers, and their allocation among sectors in a fishery could be accomplished only indirectly, by manipulating gear and fishing effort.

Almost any regulation of fishing gear, seasons or locations affects commercial, recreational and aboriginal fishers differently. To achieve objectives of equity as well as conservation as they expanded their regulatory control, governments were forced to adopt different regulations for each sector. Doing so undoubtedly had the effect of defining, and in some degree creating, separate sectors and sub-sectors, each with its own permitted methods of fishing and regulatory regime.

These events, coupled with the common property character of fisheries and the difficulty of measuring the value of fish in alternative uses, left governments with the increasingly onerous task of allocating catches among sectors. Contention is inevitable because more to one sector means less to others. It has sometimes proven so difficult that governments have acceded to pressure to increase the allocation to one without offsetting reductions in others, leading to overfishing, stock depletion and ultimately losses for all. The dismal state of many of the world's ocean fisheries owes much to this difficulty.

The introduction of individual quotas in the late 1970s and 1980s was a new turning point. The economic effects of defining fishing rights quantitatively have been profound, because the specification of each fisher's entitlement to the catch eliminates the wasteful competitive race for the fish and the associated overexpansion of fishing capacity, high costs and dissipation of resource rents.

Moreover, individual quotas have increased the value of catches by enabling fishers to take the time and effort to clean and process fish for higher prices. And perhaps most important in the long run, they have created strong economic incentives for fishers to cooperate in conserving and enhancing stocks and in managing fishing, as these measures all increase the value of their fishing rights. Increased profitability has also facilitated cost recovery which, coupled with fishers' participation in managing their fisheries, has improved administration and management through increased transparency, outsourcing, and pressure for cost efficiency.

The individual quota management system, pioneered by New Zealand, Iceland, Australia and Canada is now an important element of fisheries organization in many western countries and in hundreds of fisheries, and is associated with widespread improvement in both the management of stocks and the economic performance of commercial fisheries (Arnason, 1996).

Through this evolution, rights to fish have gradually acquired the attributes of property, with increasing duration, security, exclusivity, transferability, divisibility and

flexibility. Back when anyone could fish, fishers held no property rights because their rights were no different from those of everyone else. When they were required to hold licenses, and licenses were restricted in availability, these fishing rights began to take on these characteristics of property, and they have been progressively strengthened in some of the more advanced fishing regimes through longer duration, even perpetual terms, greater transferability and divisibility (especially under individual quotas) and increased security against interference from outsiders.

Often, in the face of anxieties about "privatization" of the fisheries, governments have denied that they were creating property rights, and there has been a good deal of analysis of the law on this question (Department of Fisheries 2005). The legal issue varies among jurisdictions, but governments everywhere claim the right to regulate fishing and, as Anthony Scott has explained, it was their progressively restrictive regulation to protect stocks from overfishing that led to restrictive licensing, individual quotas and other forms of fishing rights that, incidentally, have the attributes of property needed for efficient organization of economic activity.

4. INTERSECTORAL ALLOCATION AND TRANSFERABILITY

In the multisectoral fisheries I know, the distribution of the catch among sectors, whether they employ individual quotas or not, is not highly systematic, precise or logical. Allocations among sectors are often based on vague criteria, influenced more by established positions than by analysis of the benefits of alternative ways of utilizing resources; and they offer little security to the fishers involved. Moreover the rights held by fishers are limited in important respects. Some are not transferable, or their transferability is restricted. Where individual quotas are employed, they typically deal only with allocation of the catch within the commercial sector. Transferability rarely extends to transfers from one sector to another, even between sectors of commercial fishers, and even when they all employ individual quotas.

Today, the arrangements for allocating catches among sectors are becoming strained in a number of countries, and there is growing interest in methods of redistributing allocations. Pressure to change catch shares is not a new phenomenon, of course; it is to be expected wherever there are two or more sectors in a fishery. But particularly notable today — and the issue worth noting — is the increasing difficulty in reconciling the individual quotas of commercial fishers with the demands of aboriginal and recreational fishers.

Thus, in New Zealand, expanding recreational catches in some fisheries, and the resulting erosion of commercial fishers' quotas, has become an urgent issue (Edwards 2000). Similar concerns are developing in Australia, Canada and the United States. Both New Zealand and Western Australia have recently launched major reviews of their policies on allocation among sectors. Other jurisdictions are examining ways of transferring fishing rights among commercial sectors, and a number have been developing arrangements for transferring rights from commercial to aboriginal fishers.

The new pressures being felt in a number of countries arise from the conflicting interests of commercial fishers operating under individual quotas and non-commercial fishers which do not. The general problem is that the allowable catch available to the commercial sector, to be allocated among the individual quota-holders, is determined by subtracting from the total allowable catch, an allowance for the non-commercial sectors. These allowances are not fixed, and the criteria for determining them are more or less vague. Commonly, the demands of both the aboriginal and recreational fishers have been growing, and so have their catch allocations. As they grow, the residual catch available to the commercial fishers shrinks, undermining the security of their fishing rights.

The contribution of the individual quota system to this conflict is the increase in value it has generated for the commercial sector; the substantial value capitalized in

fishing rights has raised the stakes in this erosion of commercial access to resources. Otherwise secure individual quotas are rendered insecure by the uncertainty about sector shares. This problem is particularly acute: where the catch is shared and highly valued by both commercial and non-commercial fishers but the entitlements of each sector are not defined; where only the commercial sector employs individual quotas and; where the recreational catch is growing— such as snapper in New Zealand and Western Australia, and halibut in the United States and Canada.

This conflict between the sectors with individual quotas and those without has led some commentators to suggest that when quota systems are adopted all sectors should be included. This advice comes too late, of course, wherever individual quotas are already in place for commercial fishers. And, as a more general matter, if the quota system had to be acceptable to all sectors before being introduced, there would probably be few in place today.

Moreover, there might be some confusion about the root of the problem. It is not due to the lack of individual quotas in all sectors — it is due to the lack of a clear definition of each sector's share in the total catch. The difference is important; the solution requires only a clear specification of each sector's share of the catch.

5. IMPROVING INTERSECTORAL ALLOCATIONS

There are two broad avenues for improving allocation methods: build on the governmental model and provide for market mechanisms. The governmental approach leaves the determination of sectoral shares to political or administrative decision-making. The advantage is that it builds on existing processes, has structural simplicity, and is responsive to values and interests other than economic ones. But it preserves all the shortcomings of governmental decision-making, especially insofar as it does nothing to encourage utilization of the resource to best economic advantage; it aggravates competitive lobbying among groups with the governmental authority at the centre of contention; and it maintains a competitive barrier to cooperation and collective action among those who share the rights to fish in a fishery.

An efficient intersectoral allocation system must meet two requirements: certainty about catch shares so fishers can organize their operations efficiently, and some means of redistributing the shares to ensure the most beneficial utilization as conditions change. Governmental decision-making does not lend itself well to reconciling these needs. To calculate the optimal sectoral allocations governments would need enormous amounts of information and they would inevitably have difficulty altering sectoral shares. But this is a role markets play often and effectively, as demonstrated in the allocation of individual quota rights among commercial fishers. With minimal information other than the price of fishing rights, fishers can bargain with other fishers to solve these problems, which governments cannot do.

The present obstacle to harnessing market forces is that the rights held by fishers in one sector are typically not transferable to other sectors and, even if they were, market trading among sectors would be frustrated wherever the catch share of any sector isn't clearly defined. To correct this; well-defined initial shares in the catch must be established for each sector in the fishery, and these shares must be divisible and transferable.

6. THE NEED FOR DEFINED SECTORAL SHARES

For markets to function efficiently in allocating fishing rights among sectors to best advantage, the rights must be well-defined and secure in all sectors. This calls for an initial allocation for each sector. Establishing starting positions has often proven to be the most difficult step in introducing individual quotas, but for sectoral allocations there are usually established positions, priorities or targets of some sort already in place. The problem is that they are typically vague, often encumbered by policies giving

preferential treatment to one sector over another, and for other reasons unreliable and insecure. The need is for a clearly-defined share of the catch for each sector, secure enough to serve as a basis for bargaining and trading in fishing rights.

The benefits of well defined shares for each sector extend beyond their stimulus to trade. They also sharpen incentives to invest in stock rebuilding and enhancement, otherwise blunted by uncertainty about how much of the increased yield may be taken by others. They will facilitate treaty settlements with First Nations who, in treaty negotiations in Canada at least, have sometimes been reluctant to accept fishing rights to be transferred to them from commercial fishers because the commercial rights, being calculated net of growing recreational allowances, are seen as too uncertain. And defined shares focus the incentives and effort of fishers in all sectors of the fishery on opportunities to improve their resource base and management efficiency.

It should be emphasized that clear specification of each sector's share of the catch will be beneficial, whether the sectors employ individual quotas or not, though the financial implications will be greater for fishers holding individual quotas. Moreover, defined sectoral shares will be beneficial whether market trading is to be adopted or not, though their implications for long-term efficiency will be much reduced with subsequent trading.

7. THE NEED FOR INTERSECTORAL TRANSFERABILITY

Defining each sector's share of the catch will alleviate the uncertainty and conflict where one sector could otherwise expand at the expense of another. But, to enable market processes to effectively provide for reallocations to rationalize fishing among sectors, the shares must be divisible and transferable between sectors.

There are varying constraints on meeting this need.

The communal ownership and non-transferability of aboriginal and treaty rights to fish inhibit redistribution, though such rights can often be transferred temporarily. Usually, customary and subsistence fisheries are accorded some priority over other fishing, and in countries such as New Zealand and Canada recreational fishers also claim they have, or should have, a general priority over the commercial sector. Not surprisingly, groups enjoying a priority resist any disturbance to their position.

Nevertheless, there is plenty of scope for markets in fishing rights to function in reallocating shares in the catch among sectors to best advantage. The provisions needed depend on whether individual transferable quotas are already in place. If they are in place for all sectors, the problem is relatively simple: government must ensure that there are no impediments to the divisibility and transferability of the quota rights among sectors, as well as within them. The allocation among sectors will then be determined by the purchases and sales of quota among individual quota-holders in different sectors.

Many fisheries involve only commercial sectors, distinguished by the gear they use or the areas fished. Here, market transfers between commercial sectors can be accommodated relatively easily, as illustrated by the legislative provisions to do so in Australia and Iceland (Kaufmann *et al.*, 1999; Runolfsson, 1999).

A couple of caveats to this simple facilitation of trade are needed. To ensure that transfers of fishing rights to vessels that use different gear, or fish in a different location, do not frustrate management of the stock, intersectoral transfers should, in general, be subject to regulatory approval, as provided for in Australia's legislation. In addition, all individual quotas must be denominated in terms of the same base — that is, as shares of the total allowable catch (and not shares of a sectoral allocation as is often the case at present).

In the more challenging case in which one or more sectors in a fishery does not employ individual quotas, fishers have no individual entitlement to any part of the catch, so they cannot trade in fishing rights. To adjust their allocation through trading the fishers in such sectors need an organization with authority to represent them, hold

their sector's total allocation, raise and hold money, and buy and sell fishing rights on their behalf.

These changes are currently underway in Canada's Pacific halibut fishery, which is dominated by a commercial sector organized under individual quotas. The expanding recreational sector has recently been assigned a percentage share of the allowable catch and the Minister of Fisheries has declared that he expects recreational fishers to turn to the market to acquire more quotas if they want to increase their share in future. Meanwhile, the recreational sector's initial allocation exceeds its catch, and the commercial sector has leased the recreational sector's uncaught surplus in return for cash.

Thus rights to fish can be made transferable between sectors in a fishery through market mechanisms even where fisheries are not organized around individual quotas. But individual quotas will undoubtedly facilitate intersectoral transfers. A prominent example is the way New Zealand's quota management system has facilitated the transfer of fishing rights to Maori to settle aboriginal claims. Soon after the system was introduced, it was found to be in breach of the treaty with New Zealand's aboriginal people and thus triggered a Maori claim. But the quota management system also provided the government with a mechanism for satisfying the claim, by purchasing quota from commercial fishers for redistribution to Maori — a direct transfer of rights to the catch which would not have been possible under the earlier open-access fishing regime. Through these governmental reallocations and further purchases of quotas by Maori themselves, the Maori have become major players in New Zealand's fishing industry and their fishing rights have been integrated with the commercial sector's quota management system (Nelson, 1995).

In Canada, recommendations a colleague and I recently made to the governments of Canada and British Columbia would introduce individual quota licenses in the salmon fishery and similarly accommodate treaty settlements with First Nations by enabling direct transfer of shares in the catch from commercial to aboriginal fishers (McRae and Pearse, 2004).

Individual quotas can be expected to facilitate intersectoral transfers in other ways as well. With individual quotas in all sectors, fishers do not have to depend on an organization to carry out their trading; individual fishers can transact directly themselves. Further, where individual quotas are employed in all sectors, they provide the sectoral shares with an underpinning of entitlements, making the quota rights more secure and marketable.

Recent developments in recreational and aboriginal fisheries suggest that the path of development in the non-commercial sectors is likely to be opposite to the one we have witnessed in the commercial fisheries. In commercial fisheries, adoption of defined allocations to individual fishers has provided the stimulus for them to organize themselves into sectoral organizations to advance their collective interests and enable them to participate in management. In the recreational and aboriginal sectors, the sectoral organization might have to come first, and when the organizations have become sufficiently developed they might take responsibility for determining how their share of the catch should be distributed among their members and how their fisheries should be managed.

Thus the Nisga'a people, a large tribal group in Canada, having recently reached a comprehensive treaty settlement including substantial provisions for fisheries, quickly organized their own fisheries management arrangements and introduced their own individual quota system, all well integrated within the wider governmental management arrangements. This example illustrates both the capability of an established organization to organize fishing among its members and the effect of a clear and secure share of the catch on incentives to participate in management.

Aboriginal groups, once equipped with a defined share of the catch, can relatively easily take the further step of participating in a fishery-wide individual quota scheme,

as the aboriginal organization holding the entitlement can, like a fishing corporation, be treated as one 'individual' quota holder and organize its fishing as it sees fit. Locally-based recreational groups might similarly seek an allocation of the recreational sector's share and participate in an individual quota system.

This "bottom-up" organization implies a reduced role for government in initiating and administering allocations within recreational and aboriginal sectors, but it also suggests that governments wanting to encourage fisheries self-government should give high priority to helping these groups to organize themselves. Aboriginal people typically have organizations already, based on tribal or other traditional groupings, and in Canada, United States, New Zealand and Australia these organizations are taking increasing responsibility for managing 'their' fisheries. Recreational fishers also appear to be trying to organize themselves in many jurisdictions, often in reaction to the strengthening position of commercial fisheries.

Recreational fishers undoubtedly face the most daunting organizational task, because they are usually so numerous, disparate, dispersed and varying in their interests and commitment to fishing. Often, they have little enthusiasm for participation in management, preferring to rely on government.

Most urgent, where recreational fishers share the catch, is the resolution of their allocation. As noted earlier, recreational fishers often resist defined catch shares, viewing them as restrictive of their opportunities. Whether this is an accurate perception or not depends, of course, on their potential allocation relative to their present position. In the Canadian halibut example mentioned earlier, the recreational sector benefited from an allocation that exceeded its catch, the opportunity to sell their surplus and build an endowment fund, and the opportunity to acquire a larger allocation in the future. There are many other possible ways to make a sharing arrangement attractive, such as provisions for sharing the increase in catch resulting from investments in stock rebuilding and enhancement.

Defined shares will encourage organization, but organizations of recreational fishers, particularly, need support to get started, at least. Most importantly, they need to be empowered to take on management responsibilities, including the right to organize themselves and to require everyone they represent to become members to protect against free riders, to levy fees to finance their activities, and to make rules and enforce them. In addition, most need help with capacity development, finance and other resources.

8. PROPERTY RIGHTS AND SELF-GOVERNMENT

The extent to which fishers, responding to economic incentives, can be relied upon to allocate catches and manage their fisheries for maximum value depends critically upon their ability to control their supply of fish, which in turn depends upon the scope of their fishing rights. In my opinion, this link between the rights of fishers and their ability to manage is key to the successful development of market-based fisheries management regimes. At the risk of oversimplification, I can summarize my comments in terms of this relationship.

For centuries, fishers had no rights and no control over other fishers or potential fishers. This was appropriate as long as the supply of fish exceeded demands and fish were (or were perceived to be) inexhaustible. In these circumstances, fishers had neither the means nor the incentive to organize themselves and participate in management.

Gradually, demands grew. To protect the stocks from overfishing, governments, lacking the power to grant exclusive property in fisheries, applied restrictions on fishing methods. They also prohibited everyone from fishing except those issued a license or other authorization, who thereby acquired collective exclusivity of access. Fishers now had rights, but the rights were too weak to assure them of a secure supply of fish in the face of increasing competition for the catch (Scott, 2000).

A solution was found in individual quotas, which have substantially strengthened the rights of fishers and restored their control over their catches. Their right to a defined harvest has eliminated the wasteful competition and interference from others. The right to transfer their rights has enabled them to rationalize their operations. And their proportionate interest in the catch has given them an incentive to cooperate with each other to manage their fishery and the resources they depend upon.

These rights, providing they are well crafted, are sufficient to enable fishers to manage their fisheries effectively in the simplest case where the fishery consists of only one sector and is not affected by other fisheries or external activities.

But the control afforded by individual quotas is not sufficient where two or more sectors are involved — unless the entitlement of each sector is clearly defined. If not, the rights of fishers in all sectors are at risk. In that case the solution parallels the prescription for individual transferable quotas: assign each sector an explicit, initial share of the catch to restore certainty and establish starting positions, and; make the shares divisible and transferable among sectors to enable fishers to realize the gains from rationalizing fishing among sectors. Defined shares can be expected to sharpen fishers' incentives to cooperate in management, and trade in catch shares will tend to reduce the barriers between sectors and broaden the ambit of management organization from sectors to whole fisheries.

Other circumstances call for developing fishers' rights in different ways. Where two or more fisheries are interdependent — that is, where one stock is linked to another by a predator-prey relationship, where two or more species compete for common food or where one is affected by the process of fishing for another — there will almost certainly be opportunities to increase the aggregate value of production from the fisheries combined by increasing production of higher-valued species at the expense of lower-valued species. Fishers will be able to affect such trade-offs and maximize the aggregate value of production only if their rights extend to negotiating the size and catch of their stock with the fishers in related fisheries.

Thus, in New Zealand, the Challenger scallop and the Nelson dredge oyster fisheries occupy overlapping areas and the harvesting and enhancement activities of each affects production in the other. In this case, many of the fishers hold quota in both fisheries, and they have joined in an effort to maximize the return on the two fisheries combined.

Such arrangements can be extended to respond to the growing pressure in advanced fishing nations to shift the focus of management from individual fisheries to whole aquatic ecosystems (McClurg, 2002). Where many interdependent species and fisheries are involved a management plan designed to maximize the economic return from the whole ecosystem may involve a large number of trade-offs, costly biological and economic information, and complicated compensatory payments among quota holders. In these circumstances fishers are likely to seek efficiency in a single enterprise or cooperative to hold the fishing rights for all the interactive species and internalize the benefits and costs of all the adjustments needed to maximize aggregate returns (Arnason, 1999). Such an organization could accommodate non-commercial interests, such as sport fishers wanting to purchase quota for certain species from the enterprise for their own recreation, or environmental organizations who wished to acquire but not exercise rights to the catch, to reduce exploitation of the species.

A step in this direction is being taken by fishers in a cluster of groundfish fisheries on the coast of British Columbia. Hitherto, the fisheries have been separately organized and managed, most under individual quotas, but the fishers in each fishery incidentally take significant quantities of the other species which they have been obliged to discard. They have recently formed an umbrella organization and negotiated amendments to their fishing rights to allow them to trade quota among fisheries - one species for

another - thus improving the efficiency of operations and eliminating waste (Diamond Management Consulting Inc., 2005).

These examples are intended to illustrate the strengthening of fishing rights needed to cope with progressively broader sources of interference with fishers' control over their fish supplies — from other fishers, other sectors, and other fisheries. Although this leads beyond the terms of reference for this discussion, I should add, for completeness, the challenge of allocating ocean space among fish production and other competing uses of the sea, such as navigation, mining, aquaculture, waste disposal and preservation of the natural environment as well as fisheries.

Where fish production competes with other uses of ocean space or marine environments, market mechanisms can determine the most beneficial use or combination of uses only if the rights held by each interest group include the right to make trade-offs in their demands on the ocean. This may call for a super- organization of fisheries groups capable of bargaining over fisheries production with parallel organizations of industrial, environmental and other interests with demands on the same ocean space (Scott 2006).

9. THE ESSENTIAL ROLE OF GOVERNMENT

Throughout this presentation I have emphasized the scope for harnessing market forces and the resources of those who hold the rights to fish to manage fisheries. I will conclude with a comment on the role of government.

Much has been written about the shortcomings of the traditional regulatory approach to fisheries management in terms of its inflexibility in the face of changing conditions, its unresponsiveness to differing circumstances, its demands for information, its conflict with the incentives of fishers and its costliness. And it has now been widely demonstrated that the development of new forms of fishing rights, notably individual quotas, by aligning fishers' incentives with the public interest, has enabled wholesale shifts in responsibilities for fisheries management from government to the fishers themselves, with generally beneficial effect.

However, while experience shows that the holders of fishing rights, under suitable institutional conditions, can safely be given wide responsibility for managing fishing, some responsibilities must remain governmental. As governments shed their traditional roles in regulating fishing and allocating catches the onus on government actually increases in respect of two responsibilities in particular.

One is establishing a clear and comprehensive framework of policy and administration within which those who depend on fish can conduct their affairs efficiently and with certainty. Fisheries jurisdictions vary widely in their response to this need. Australia's fisheries policy, introduced 15 years ago, is a model of clarity and rigor with its legislated statement of objectives for the fisheries, specification of management organization and of the responsibilities of the various parties and agencies, and clarification of the fishers' legal rights, and financial and other obligations.

At the other extreme are Canada's vague and inconsistent arrangements, based on antiquated legislation and developed piecemeal in response to more than a century of pressures and crises, and which lack the clarity and security needed to support modern fisheries management (Burke and Brander, 2000).

Significantly, the countries that have led the reorganization of fisheries and have benefited most from it - notably Australia, New Zealand and Iceland - have all adopted new legislation and administrative structures to accommodate their new regimes.

A carefully crafted, clear policy framework is especially important for a management regime that depends on efficient participation of fishers and non-governmental parties. Given the opportunities for self-government in fisheries, the most critical function of government might ultimately be in maintaining the legal and institutional framework to enable those with rights to fish to govern themselves.

The other increasingly important function is to protect the broad public interest in the face of harvesting and management of fish by those having a primary interest in the catch. This is largely an environmental responsibility, calling for basic rules to protect aquatic habitats and sea life which may be endangered by fishing activity, to control pollution and preserve aesthetic values. These are true public goods; the benefits accrue to society as a whole, not just to those who harvest or consume fish, so they must be provided for, if at all, by government. The governmental task is to articulate and enforce the public's long-term conservation objectives and standards of performance to be achieved. These basic requirements can be expected to leave wide scope for the holders of fishing rights to manage their fisheries for maximum economic benefit.

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Extractive and non-extractive allocation issues – an environmental perspective

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There are three universal performance criteria for managers of extractive users of the marine living resources of the oceans: yield, sustainability and equity. Depending on how different managers with different mandates interpret, apply and perform against these three criteria, however, a wide range of different outcomes can be aimed at – and an even wider range actually achieved.

Taking the right approach to allocation of access to fish resources thus requires choosing an entire package of measures – that go considerably beyond the scope of what normally passes for fisheries management measures – if intent is to be achieved. I shall attempt to briefly identify and discuss each interlinked element of such packages.

Most importantly, however, is to recognize that, if fairer and more equitable allocation decisions are to be made that actually deliver on governments' stated environmental, social and economic goals and commitments, a fundamental reorganization of the way the maritime activity of fishing is legitimized, managed and controlled is necessary.

1. EBM > MSY

The place to start is by doing away with the now outmoded concept of 'maximum sustainable yield' (MSY) to describe the strategic objective of fisheries managers. This rationale has been used to justify the singularly unhelpful practice of 'fishing down' the original biomass of an unexploited fish stock and then harvesting as much of the subsequent growth of recovering juveniles as can be got away with. This is exactly the same approach taken by foresters in clearing natural oldgrowth forest to replace it with managed regrowth and plantations.

The MSY concept has embedded in it the ideological notion that manipulating a wild animal population to extract as much human benefit as possible, indifferent to impacts on the ecosystems and any related species involved, is an appropriate approach for resource managers, and for the fishers they manage, and an acceptable basis for government policies – it is not.

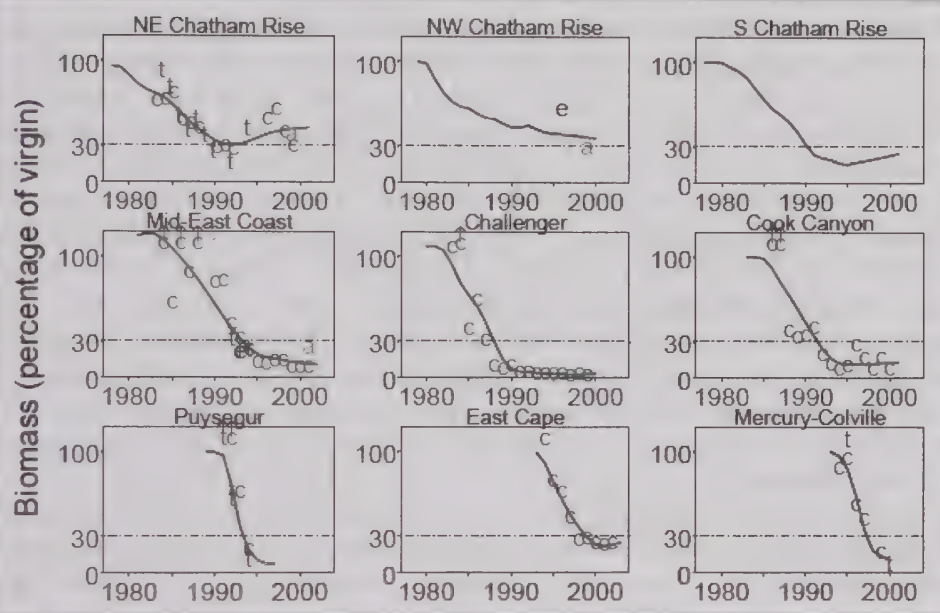
I am delighted to say that the concept of 'ecosystem-based management' – or EBM – is beginning to replace the concept of MSY as the basis for ocean and coastal resource management. It is important that this concept invades the minds, as well as the mouths, of fishers and fishery managers just as quickly as can be done.

The obstacles to making such a fundamental shift should not be under-estimated. When UNCLOS – the law of the sea convention – was negotiated in the 1970s and '80s, conservation considerations did not weigh on the minds of negotiators and MSY is actually enshrined therein as the objective of fisheries management – in the context of restricting a coastal state's ability to retain unexploited or under-exploited fish stocks in favour of the interests of foreign fishing fleets.

Even when ecosystem considerations are now more widely accepted in the international community, the World Sustainable Development goals adopted by governments in 2002 still identify MSY as an aspirational goal for fisheries management - albeit only in the context of recovering overexploited stocks. This is somewhat ironic in that it is hard to escape the conclusion that the concept of MSY has been little more than rhetorical veneer to cover for the serial depletion of those fish stocks (Figure 1 and 2).

FIGURE 1

Biomass decline in selected New Zealand orange roughy stocks



Source: Malcom Clark, NIWA.

FIGURE 2

Biomass decline in selected Canadian benthic fish species

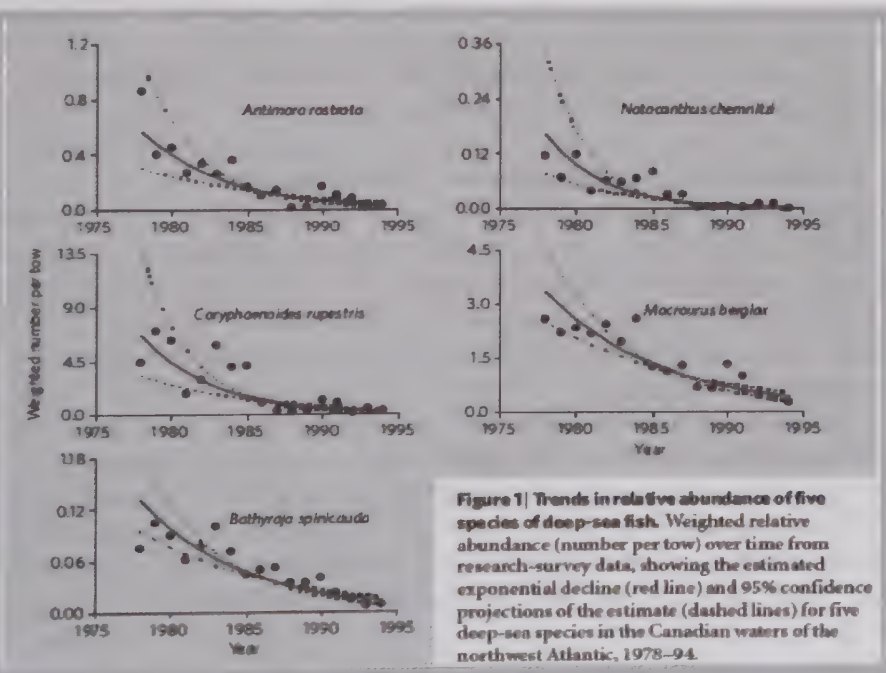


Figure 1| Trends in relative abundance of five species of deep-sea fish. Weighted relative abundance (number per tow) over time from research-survey data, showing the estimated exponential decline (red line) and 95% confidence projections of the estimate (dashed lines) for five deep-sea species in the Canadian waters of the northwest Atlantic, 1978–94.

Source: Devine, Nature Vol 439/5 January 2006.

1.1 Intergenerational equity

Of all the allocational offences inherent in the MSY approach, perhaps the worst is the offence to intergenerational equity – the notion that each generation should leave its part of the planet in at least as good a state as we found it. The universal recounting of stories by older fishermen about bygone days when fish were more plentiful only compounds the offence.

Among other changes, genuine acceptance of EBM requires development and adoption of approaches to management that place the harvesting of a particular stock of fish in the much broader context of a commitment not only to maintaining the basic health of marine ecosystems as a whole but also to fostering the wellbeing of all marine species (including the target population) and their habitats.

In turn, adoption of an EBM approach requires fundamental institutional realignment whereby agencies with responsibility for sectoral management of fishing, as just one of a range of legitimate maritime activities, can be placed in a context set by broader institutional arrangements with the mandate and power to coordinate maritime activities and determine integrated outcomes – including allocation of access to marine areas in both space and time, and to set catch levels for commercial fisheries that reflect the interests of species other than ourselves and interests other than industrial fishers.

1.2 Sharing with other species

The next worst allocational offence inherent in the MSY approach is the disregard for the interests of other species and the habitats that sustain them – whether incidentally destroyed by bottom trawling, as bycatch and incidental mortality, etc., or competitively starved by removal of critical food supplies – to say nothing of the destruction of the target stocks themselves.

It has taken the strident articulation of the wider community's concern over the fate of non-target species such as dolphins, turtles, seals and seabirds to impress upon fishers and their regulators the needs to reach beyond MSY as the ideological and policy framework for control of fishing activities. Only the most romantically deluded among us could conclude that such a broadening of responsibility and purpose was driven by any inherent maturation of purpose within the general fishing community itself.

The point is obvious and not worth dwelling on at length – except to emphasise it's importance – and the institutional implications of taking such 'externalities' seriously. In particular, industrial fishers and their regulators should not be surprised if their ideas for allocation of tradable property rights to fish resources are met with some amazement, fear and derision by the wider community.

2. ADHERENCE TO INTERNATIONAL AGREEMENTS

While the right to allocate and control access to terrestrial resources is mutually recognized by nation states as their inherent sovereign right, this is not the case for marine resources, where such rights are created – and constrained – by the provisions of UNCLOS - the law of the sea (and numerous other international and regional agreements). Even within coastal states' 200 mile EEZs, such international law limits the legal exercise of state power.

This is something that needs to be borne in mind by those championing the cause of creation and allocation of property rights to marine resources - it's not that simple! We have a long way to go in developing regional management arrangements and global oversight and accountability provisions before a clear mandate to create and allocate property rights to marine resources will be established - and that mandate will be heavily constrained by the obligation to share (unlike on land, where the opposite is customary).

The world is not short of such global and regional agreements where commitments to good oceans and fisheries management have been made - but we are falling well

short of formal acceptance of and effective implementation of such commitments by governments.

Coherent and comprehensive implementation of these commitments requires all eligible governments to sign, accede to and/or ratify all relevant international and regional agreements. Indeed, failure to do so represents an enormous obstacle to prompt and effective progress towards EBM.

While there is widespread ratification of the main two global agreements – UNCLOS and Convention on Biological Diversity (CBD) – there are some notable exceptions that must be addressed. Meanwhile, fisheries-specific agreements such as the Fish Stock Agreement and the High Seas Compliance Agreement are not widely ratified and even more poorly implemented, as is the case for the safe and proper operation of fishing vessels and treatment of fish workers on such vessels. At the regional level, many flag states allow their vessels to operate in areas and on stocks covered by agreements to which they are not party.

While ratification of such agreements is improving and numerous urgings have been adopted by governments, no sense of urgency is yet apparent – yet, if comprehensive acceptance of international commitments is not achieved, how are we to expect prompt and effective implementation? No state can claim to be committed to the 'decade of action' declared by the FAO's Committee on Fisheries (COFI) last March until it has at least ratified all relevant international agreements.

The days when states could get away with 'opting out' of international agreements (or of specific measures adopted by management bodies) yet still expect access to marine resources provided for by those agreements must come to an end.

2.1 No commitments? No access!

The next worst allocational offence is to allow states and the fishing vessels they flag to have access to fish resources if those states have not ratified or acceded to all relevant agreements and developed the national capacity to ensure compliance with relevant provisions. 'No commitments – no fish', and 'no compliance – no fish' should be the norm for all allocation regimes.

It is simply not fair – and an open invitation to abuse – to allow states that have not accepted international obligations to licence their fishers to operate in competition with states that have accepted such obligations.

3. AVOIDANCE OF DESTRUCTIVE FISHING PRACTICES

At the 7th Conference of the Parties to the CBD last year, governments decided that there is an urgent need to take short, medium and long term measures to control destructive fishing practices, including interim prohibitions, where appropriate. Such interim prohibitions are an obvious, cost-effective starting point – stopping making things worse (which is quick and cheap) as a prelude to making things better (which is harder and slower) – "Freezing the Footprint" of damaging and unsustainable activities.

It is obviously wrong to fish in a manner that knowing reduces ecosystem health and viability of other species – and unfair to allow such fishing practices to continue.

Take bottom-trawling, for instance – immediate short-term measures to limit bottom trawling to areas previously bottom trawled and an interim prohibition on bottom trawling in high seas areas where there is inadequate knowledge or control to avoid significant harm is clearly justified. In response to a campaign by environmental NGOs against unmanaged bottom trawling on the high seas, this year's United National General Assembly (UNGA) will consider adoption of an interim prohibition on bottom trawling – and maybe all unmanaged destructive fishing practices - outside EEZs and areas covered by management regimes capable of regulating such activities.

Again, what happens at the UNGA will clearly indicate real commitment to COFI's call to move from words to action. While some states have taken some steps towards such interim prohibitions both within their own EEZs and within regional management bodies in which they have a conservation and management interest, progress is limited and slow.

It is obviously most unfair that fishers that have been excluded from one fishery as effective controls have been introduced (or ineffective control allows stock depletion) can merely move on to a new fishery on the high seas and engage in licenced plunder.

With respect to the high seas, whatever happens in the short term at this year's UNGA, medium term actions are needed to ensure that existing management arrangements, including Regional Fisheries Management Organizations (RFMOs), are expanded with respect to both competency and geographic coverage to establish effective regional ecosystem management arrangements capable of delivering ecosystem-based, integrated oceans management.

In the longer term, these regional ecosystem management arrangements need the time and resources to allow appropriate conservation measures to be developed that ensure appropriate restriction of destructive fishing practices – thus obviating the need for interim measures – what Greenpeace has been calling Regional Ecosystem Management Bodies and WWF has been calling Regional Oceans Management Organisations.

The extent to which we need to see sectoral regulatory bodies amalgamated into single new regional bodies capable of delivering EBM through regulation of all relevant maritime activities or merely impose regional coordinating and control arrangements upon such sectoral managers is an open question. With industry good will, mere coordination should suffice, but I fear that, on past experience, strong regional institutions capable of over-ruling sectoral agencies articulating vested interests – or even replacing them – will be needed.

The next worst allocational offence is to allow industrial fishers to exploit high seas fish resources without any management framework having been established – let alone management measures developed and applied. Such offence is given by flag states by the simple expedient of licencing their vessels to fish on the high seas in the absence of any such arrangements – something supposedly responsible states, like Australia, are just as guilty of as those more customarily regarded as irresponsible.

4. FAIR AND EQUITABLE ALLOCATION OF FISHERIES RESOURCES

The concept of sharing in the oceans bounty has two key components – sharing between human needs and those of other elements of the oceans ecosystem; and sharing between human societies and economies. That such sharing should be fair and equitable is just the first principle to be accepted – and then elaborated and applied in practice.

The key reason why EBM must replace MSY as the basis for fisheries management is it includes an obligation to ensure that any resource extraction by humans does not cause serious or lasting harm to other species and the ecosystem relationships they rely upon – now or in the future.

4.1 Precaution – ignorance is less

The improvements in knowledge needed to make the successful transition from an MSY approach to EBM are considerable and should not be underestimated. The proper application of the precautionary principle can be used to discount harvest levels, or defer harvest decisions, in recognition of the higher risks inherent in lack of adequate information. That is to say, lack of scientific information need not prevent allowable catches being set – but fishers must accept that failure to allocate adequate resources towards both pure and applied scientific research to allow better understanding of ecosystem relationships, will result in precautionary discounting to lower catch rates.

The proper application of precaution also serves to ensure that the interests of future generations are respected – they have the right to expect to benefit from the oceans bounty in the same way that our generation does – and those that came before us.

4.2 Industrial fishers v. coastal communities

More important for human benefit, however, is the need to ensure that coastal communities, especially those in developing countries that are reliant on nearby ocean resources for subsistence and survival (including indigenous communities and artisanal fishers) are given appropriate preferential access to fish resources. Distant water and industrial fishers have the means and opportunity to choose where to fish – such coastal communities do not. Unfortunately, such foreign and industrial fishers habitually have the power and influence to get their way despite the adverse impacts on coastal communities.

From a social perspective, this is undoubtedly the most important aspect of allocation policy. In Australia this is played out in the often fractious disputes between commercial and recreational fishers – where recreational users do a pretty good job of looking after their interests. In many developing countries for instance, coastal communities generally fare very poorly when it comes to representing their interests against those of industrial fishers, especially foreign ones from developed countries – a very unequal conflict indeed.

As an aside, it has to be noted that this is the real tragedy of the commons – the failure of the state to protect weak communities against rich and powerful individuals – not the failure to allocate and exercise rights within such communities. Much as I am tempted to deliver a history lesson on the reasons for the enclosures of the commons of England, I shall resist – except to note the cruel irony in the frequent and inappropriate reference to the 'tragedy of the commons' by those who would alienate to themselves the community's interest in the fair, equitable and sustainable allocation of rights to extract natural resources from the oceans.

4.3 Catch history is 'bunk'

Closer to the present meanwhile, for deep sea fisheries, especially on the high seas, catch history should not be relied upon as the primary basis for allocating future catches. UNCLOS formally establishes the living marine resources of the high seas as being open to and belonging to all.

Open fisheries must be open to new entrants if the sustainable development aspirations of many developing countries are to be realized. This is a critically important allocation issue. Any attempt by those few countries and companies with the current means to exploit high seas fisheries to limit access to themselves is wrong – and any country seeking to encourage or entrench such limited access would be acting in breach of international law.

Reliance on catch history merely encourages excessive activity by those currently involved in unmanaged fisheries in anticipation of management being imposed and catch history being adopted as a basis for catch allocation.

4.4 Efficiency and effort limitation

Similarly, it should be regarded as desirable for governments to control fishing effort for social and economic reasons as much as for environmental ones. Restrictions on fishing gear type, vessel size and power, seasonal limitations, allocation controls will be relevant in many situations where restricting fishing effort is justified and minimizing social and economic impacts is an objective of government.

While use of market-based mechanisms, such as ITQs may have a place in appropriately institutionalized fisheries, the evidence from those countries that have relied heavily on ITQs clearly indicates the ongoing need to retain use of more interventionist measures as well if policy objectives are to be met.

Incorporation of such approaches into ocean resource allocation and management arrangements by governments that give priority to the needs of coastal communities would significantly contribute to the Millennium Development Goal relating to poverty alleviation and freedom from hunger. To rely merely on market instruments is to invite concentration of ownership in the hands of profit-maximising corporations – with no inherent expectation of responsible behaviour [viz. New Zealand orange roughy and hake, and Icelandic cod – the latter showing no signs of recovery even after twenty years of ITQ management].

4.5 Respect for science

One of the key differences between the MSY and EBM approaches to fisheries management is the substantially greater information requirements for full adoption of EBM.

More importantly, however, is the need to respect what scientists have to say about the management of target stocks as well as the implications for the rest of the ecosystem. I am struck by the number of scientists and managers who privately express horror and frustration at the lengths to which fishers will go to reinterpret scientific information and contest scientific advice in the interests of increased allocations today in the full knowledge of higher risks of collapse tomorrow.

It is hard to escape the conclusion that Australia's co-management model, for instance, may not quite be leaving the fox in charge of the henhouse but more like just giving the fox the key – the result is much the same. While I would be the last to suggest that scientists' advice should be immune from critique – by any stakeholder – vested interests in higher catch rates do seem to know how to get their way.

5. CONSERVATION AND PROTECTION OF BIODIVERSITY

The effective conservation of biodiversity and protection of particular elements is the most important driver behind adoption of EBM in an integrated manner – all maritime activities must find their own ways of avoiding undue harm to, and adequately taking care of, the same species and ecosystems as they go about their business.

Internationally, the existence of sector-specific bodies to manage and control various maritime activities, especially on the high seas, is an inevitable part of the future in the medium term at least – hence the need for cooperation and coordination if EBM is to be achieved – and the need for institutional development to ensure such coordination and sectoral performance.

There are three areas where prompt action is needed (assuming short term measures to control destructive fishing practices have been taken):

- development of networks of MPAs;
- avoidance of bycatch and incidental mortality problems; and
- shared EIA standards and processes.

5.1 MPAs to show the way on coordination and cooperation

The WSSD commitment to establishing a network of representative Marine Protected Areas (MPAs) by 2012 is bold and exciting and some countries and regional bodies have made good starts. [Note CCAMR 2005 meeting decision to establish a network of representative MPAs throughout the Southern Ocean.] Generally, however, initial progress is disappointing and, at current rates of progress, we will need the next century – not the next decade – to reach our goal.

MPAs represent the clearest and most effective single measure that can be taken by states to demonstrate their commitment to EBM – recognition that species and ecosystems have a right to exist and prosper independent of their utility to humans and that restrictions on uses in particular areas is key part of the appropriate response.

Identification, declaration and effective management of a network of MPAs requires the close cooperation of all relevant bodies responsible not only for marshalling

scientific information but also for the management and control of each maritime activity. Development of an MPA network can thus be used to pioneer development of the cooperative arrangements, including institutional developments, needed not only to deliver MPAs but also to deliver oceans EBM – thus making it a top priority for action.

Obviously, the faster and easier MPA networks are established, the less institutional reform will be justified – or called for – within coastal states, regionally and internationally.

A really important step along this path of establishing MPA networks, especially on the high seas, needs to be taken at the 8th CBD Conference of the Parties – due in March this year: taking the lead in marshalling available scientific information to identify areas warranting MPA designation according to ecological criteria that the CBD adopts. Other bodies with the mandate to control particular maritime activities on the high seas can then act upon advice from the CBD to impose appropriate restrictions on activities.

While such institutional intricacies of establishing MPAs on the high seas might appear overly labyrinthine, actually mirrors the sectoral hurdles faced by proposals to establish MPAs in EEZs under coastal state control. – that other bodies with appropriate competency can apply in controlling various maritime activities.

5.2 Bycatch and incidental mortality mitigation and avoidance

Protection of non-target species, especially by avoidance or mitigation of bycatch and incidental mortality, is a critical early step towards oceans EBM. Four main groups of species have been identified as being in particular and urgent need of better treatment – seabirds, marine turtles, marine mammals, and sharks, skates and rays.

Complementary lists of threatened species in need of similar special protection have been developed but the steady addition of more species to such lists is a strong indicator that trends in our actual performance as managers of the oceans are not good. Measures that are particularly effective for each particular maritime activity/species interaction, in each region need to be developed – and effectively implemented – backed by research to allow continual improvement in priority setting and impact reduction.

Again, progress by governments and regional bodies has been patchy and slow. It is important that political and technical investment in continual improvement is sufficient to drive rapid progress – or fishers will risk losing access to fisheries because the impact on other elements of the ecosystem are judged by the wider community to be too great.

In many cases, important policy decisions have to made to decide which species are to be classed as 'non-target' and thence offered special protection in this way. EBM can provide a process for informed judgment – but not an answer to what are basically ethical questions for we humans. While some societies, communities and countries are comfortable with the idea that some taxa (like seabirds, seals and cetaceans) should not be subjected to targeted killing or indirect killing, others are not so concerned.

5.3 EIA for all

Successful EBM requires a much greater understanding of marine ecosystems and interactions between their living and non-living components. The best way to develop – and apply – such knowledge is to require all potentially damaging maritime activities to be subject to the same requirements for Environmental Impact Assessment (EIA) and, in some cases, wider Integrated Impact Assessment (IIA) that includes social and economic effects.

An early step towards better international cooperation should be the adoption of common EIA and IIA standards and criteria by all governments, international bodies and regional bodies with management responsibility for one or more maritime

activities. Over time, this commitment to sectoral EIA/IIA can be developed into integrated, regional assessments that encompass all maritime activities- and so allow for truly Integrated Oceans Management (IOM).

Like MPAs, therefore, the introduction of common EIA principals, standards and procedures for all maritime activities can drive development of the collaboration and cooperation we need if integrated oceans management is to be achieved.

6. HIGH SEAS GOVERNANCE REFORM

While UNCLOS made it clear that coastal states had the right to manage exploitation of living marine resources within their EEZs (with important limitations), control of maritime activities on the high seas remained the responsibility of flag states. Subsequent negotiation of the Fish Stock Agreement (FSA) and the High Seas Compliance Agreement under the auspices of FAO did much to establish a framework of government obligations capable of being applied to deliver EBM with respect to high seas fisheries activities, at least.

In practice, however, progress has been disappointing – government parties to pre-existing regional fisheries bodies have been slow to upgrade the mandates of such bodies and to adopt suitable management measures. RFMOs developed pursuant to the FSA have better mandates but still poor implementation. Additionally, there are regions of the world's oceans and exploited fish stocks that are not covered by any (or by adequate) regional management arrangements.

6.1 Global oversight of regional management – the way to go

Regional management arrangements – that are genuinely committed to EBM implementation – primarily delineated according to ecological principles (and political realities) are to be encouraged to the greatest extent possible. Upgrading old and emerging regional bodies into comprehensive Regional Ecosystem Management Arrangements (REMAs) that cover all regions and all fisheries activities and, further, by delegation and amalgamation of responsibilities held by various international and regional bodies, creation of Regional Oceans Management Organisations (ROMOs) must happen – and quickly.

Experience has shown, however, that states habitually take very limited agendas, driven by limited sectoral priorities, into meetings of RFMOs. There is no grounds for assuming that states will actually seek to meet their global responsibilities when participating in regional management of marine living resources. It is therefore prudent to establish new global oversight arrangements that make regional management accountable to global commitments – so that all states with an interest in the conservation and management of a region can satisfy themselves that those among them that assert a so-called 'real interest' in the region are doing the right thing.

It is encouraging that, at last year's COFI meeting, some states have expressed an interest in an external review of the capacity of existing regional fisheries bodies to meet the demands of EBM and elimination of IUU fishing (illegal, unreported and unregulated fishing). Such like-minded states should be urged to commission and complete such a review as quickly as possible and so set the agenda for requisite reform.

6.2 An UNCLOS Implementing Agreement for high seas EBM

The extent to which such developments require a broader mandate than that already provided by existing agreements is an open question. Exploration of a new UNCLOS Implementing Agreement to provide a comprehensive regime for high seas biodiversity conservation is an encouraging development and deserves urgent attention – although, development of customary international law through responsible action should not be delayed in anticipation of such formalization.

Importantly, any such Implementing Agreement must be comprehensive in its potential for biodiversity conservation – not just allowing for MPA designation and extending FSA coverage to include discrete high seas fish stocks – and in its application to all maritime activities – no exemptions for fishers, miners or shippers.

Most importantly, the time has come to assert that fishing by fishing vessels flagged to states that are not parties to relevant international and regional agreements and by fishing vessels in areas or on stocks not covered by regional management arrangements be deemed to be engaged in IUU fishing and thence designated as stateless.

Furthermore, responsible states should ensure that such states and such fishing vessels are denied access to fish resources both within EEZs and on the high seas. Such action would make it much easier for responsible states to take effective action against them – and so end the scourge of IUU fishing – thus demonstrating a commitment to move from words to action.

Similarly, the time has come for real action to be taken against flag states that do not meet their UNCLOS obligation to maintain an 'genuine link' with any fishing vessels flying their flags – the so-called 'flag-of-convenience' states. In particular, it is important that the beneficial owners of fishing vessels must be transparently notified and steps take to ensure that they can be held liable for the activities of the fishing vessels and fishers that they control. In effect, flag states should only be flagging vessels that operate in their own waters or, if operating on the high seas, are beneficially owned by their own citizens with adequate assets within their jurisdiction, unless specific bilateral arrangements are in place with other states.

Use of flags of convenience by fishers is obviously unfair – as well as being a serious threat to effective management of resources – a calculated move to avoid and subvert rules enforced by responsible states and respected by responsible fishers. For all its legalistic interpretation, IUU is a term that neatly describes these bad actors – and its elimination must be a clear and pressing goal for all.

Importantly, the OECD-hosted and ministerially-led High Seas Task Force on IUU Fishing is due to hand down its final report in early March 2006 and should identify a suite of measures that should be taken by all responsible governments.

7. ADDRESSING OVERCAPACITY

Unless firm action is taken, overcapacity (too many fishing vessels chasing too few fish) is to be expected as so many different factors contribute to it: technological advance means fewer vessels can catch more fish; both introduction of sustainable management and continued overexploitation result in lower catch rates needing fewer vessels; rising population and living standards but less fish means higher prices; and subsidies for the construction and operation of vessels encourages overexploitation.

Additionally, a bureaucratic culture of not caring what happens to vessels displaced from managed fisheries by such trends means that a large and growing fleet of fishing vessels is under growing economic pressure to break the rules or try their luck on those areas of the high seas where there are yet no rules – and to break the rules in those areas where they think they can get away with it. An industry culture of disdain for governments, and a broader failure to provide realistic regional development alternatives back home, makes such an outcast life more attractive than it should be – or need be.

7.1 Scrap to prosper

Whatever else is done, we need more scrapping schemes – the permanent removal of fishing capacity not only from a particular fishery but from the stock of world fishing capacity. We have a few examples of such schemes to work from and much theoretical advice to work with – and, if ever there was an area where it is time to talk talking and start acting, this is it.

In particular, creation of new vessels – whether subsidized or not – must be matched by obligations to remove a greater amount of fishing capacity. Encouraging and monitoring scrapping of fishing vessels relieves a whole range of pressures not only on fish stocks themselves but also on managers of those resources.

At the same time, scrapping schemes must be matched with regional development packages that provide realistic, viable and honourable alternatives for fishers, their families and their communities – in recognition of the real social and economic costs of insisting on EBM.

8. MONITORING, CONTROL, SURVEILLANCE AND ENFORCEMENT (MCS&E)

Improved management of responsible fishers as well as effective deterrence of irresponsible ones (IUU fishing), requires more and better MCS&E. This applies particularly to fishing vessels capable of deep sea fishing that can readily turn to distant water fishing, high seas fishing, and IUU fishing and so creating huge challenges for coastal states and regional management bodies.

It also requires better identification and control of those managers and beneficial owners of such vessels capable of making such decisions as a key part of effective deterrence strategies aimed at those engaged in or tempted by IUU fishing. Such improvements in MCS&E do not come cheaply or easily, thus requiring:

- Regional cooperation between coastal states and governments involved in regional fisheries arrangements;
- International cooperation where issues and problems extend beyond the region or action is needed at the global level; and, most importantly; and
- Specific assistance programmes are developed to help developing flag, port, coastal and market states improve participation and performance in MCS&E arrangements.

The OECD-hosted, ministerially-led Task Force on IUU Fishing on the High Seas (HSTF), established following WSSD, is due to report in March 2006 and is expected to make key recommendations in this area, including such matters as:

- Maintaining a global register of vessels capable of fishing on the high seas, including identification of the managers and beneficial owners of such fishing vessels, and operational histories of such vessels;
- Converting the current informal network of MCS agencies of likeminded governments into a new global institution to support, coordinate and encourage states and relevant international and regional bodies to improve MCS effectiveness;
- Coordinating lists of good and bad vessels and their beneficial owners and flag states as identified by both sates and regional bodies;
- Improving transparency so that the enormous support of civil society for the efforts of governments to eliminate IUU fishing can be harnessed to support and complement the work of governments – so that IUU fishers will be left 'nowhere to hide'; and
- Reviewing the competency and mandates of existing regional fisheries bodies with a view to expanding mandates and geographical coverage to ensure IUU elimination and EBM can be achieved throughout the oceans.

9. CONSUMER CHOICE SCHEMES

As part of the efforts by the wider community to assist governments, it is encouraging to see the development of numerous consumer choice schemes around the world and the preparedness of FAO to develop technical guidelines for their operation. Such initiatives deserve the support and encouragement of all – especially through improved information sharing that can lead to better coordination, avoidance of conflicts between lists and, eventually, to greater harmonization of messages in particular markets.

It is important to recognize that the fair allocation of living marine resources is not just a matter for fishers, fishery regulators and governments. Ordinary citizens as consumers have a right to have an influence – and a duty to ensure that they know what the ecological footprint of their consumption habits is. Indeed, this is the key area where market forces can best help deliver better environmental performance – on the assumption that a properly informed consumer will make prudent and responsible choices.

Ideally, each major seafood market in the world should have its own coalition of consumer interests encouraging individual consumers to make informed choices to send market signals that support those fishers and fisheries that deliver on environmental and social outcomes – and penalize those that do not.

Similarly, it is hard to believe that the citizens of East Asia would be so keen to have shark-fin soup on the menu for customary celebrations if they knew how devastating an impact their choices were having on oceans health (although it must be noted that Hong Kong has just overtaken Tokyo as the biggest single fish market in the world – and that shark-fin is the single biggest item of trade by value)

Fortunately, however, there is a particularly good opportunity for such consumer schemes to help with discouraging unsustainable and IUU fishing of pelagic and deep sea species, especially on the high seas. There is a growing list of such species that have been so poorly managed and overexploited that they warrant listing on Appendix II of CITES let alone consumer choice red lists. [CITES is the Convention on International Trade in Endangered Species of Wild Flora and Fauna

Governments need to take note that the concerned communities of the world will not idly wait for governments to fix their governance gaps and unsustainable fishing by their vessels and citizens. Consumer choice lists and CITES listings both offer real opportunities to support governments trying to do the right thing and to discourage fishers that are not.

10. GREATER GOVERNMENT RESPONSIBILITY NEEDED

Once governments have ratified relevant international and regional agreements, and thus legally obliged to implement their provisions and ensure compliance with their rules, governments are then obliged to adopt measures to meet those obligations. There is much more to be done by most governments in all areas of responsibility:

10.1 FLAG STATE RESPONSIBILITY

It is no longer acceptable that states can exercise their right under UNCLOS to operate a vessel register that includes fishing vessels while failing to meet their UNCLOS responsibility to establish and maintain a genuine link with such fishing vessels. Governments have not yet even defined what is meant by that 'genuine link' despite much liaising and talking by relevant agencies and international bodies.

While there may be good reasons for responsible operators of merchant shipping to use flags of convenience, this is not the case for fisheries activities. To allow owners and operators of fishing vessels licenced to exploit marine resources, especially on the high seas, to hide behind veils of corporate secrecy, anonymous societies and limited liability companies should no longer be acceptable government practice.

Exercise of flag state effective responsibility over fishing vessels is no easy task and states operating vessel registers should be invited to make the necessary investments in establishing the capacity required – or to cease registering fishing vessels other than those operating in their own waters and beneficially owned by their own citizens. Fishing vessels flagged to states that do not do this should be refused access to fisheries, port facilities and markets by responsible states.

10.2 Port state responsibility

It is encouraging to hear that port states are generally moving to improve oversight of fishing vessels using their ports. FAO has produced an excellent model of the kind of

control measures port states should be implementing. Of particular importance is the need to insist on port-to-port VMS tracking so that port authorities can ensure that fishing vessels have only been where they are licenced to go. It is important that port states develop regional port access agreements to stop IUU fishers 'port-hopping' in the same way that they 'flag-hop' to evade responsibility. A key part of such an agreement should be the global reporting of port movements by deep sea fishing vessels to support MCS&E efforts by coastal states and regional bodies.

10.3 Market state responsibility

As with all food products, consumers expect and demand more accountability and responsibility by producers, traders and processors of the food they eat – and fish is no exception. Market states must be able to ensure that their consumers receive credible and reliable information and that access to their markets can be controlled in support of any trade measures adopted in support of sustainable fisheries management. The extent to which appropriate chain of custody measures are put in place can be expected to become a significant measure of progress towards EBM and Integrated Oceans Management.

10.4 Control of nationals

Most importantly, governments must be willing and able to ensure that their own citizens and companies do not get involved with or benefit from IUU fishing. That some countries are taking such steps is very encouraging and revealing an important reality – that, in most cases, those engaged in and benefiting from IUU fishing are based in developed countries and exploiting the poor institutional and governance arrangements in many developing countries to shirk their responsibilities and evade liability for the activities they control.

11. AQUACULTURE

Finally, it is time to sound a warning about the continued growth of the marine aquaculture industry, especially the farming of carnivorous fish like salmon and trout. In last year's State of the World Fisheries Report, the FAO noted that already 30% of all wild capture fish are fed to fish farms. A number of concerns need to be raised:

At such high levels of diversion of fish resources from fully exploited fisheries, less fish meal, fish oil and frozen small pelagic fish products are available to meet traditional needs and markets, putting pressure on coastal communities;

Small pelagic fish are diverted from providing food and wealth for coastal communities in developing states to generating smaller volumes of fish for luxury markets in developed countries – risking perverse economic development outcomes;

The sustainable management of pelagic fish stocks are coming under increasing pressure – and, in most regions, exploitation of high seas stocks are not under effective control posing a dire risk of overexploitation; and

Wild populations of predatory fish, including tuna, if not already depleted by over-fishing, face reductions in their food distribution and abundance with potentially adverse impacts.

There is thus a risk that naïve encouragement of further rapid development of salmon farming in particular will undermine government efforts to meet social and environmental policy commitments.

Furthermore, almost every allocation problem identified so far stands to be exacerbated by further growth in salmon farming – growth that is planned by many companies and encouraged by many governments.

Resource sharing – key to sustainability*

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Good morning, ladies and gentleman. In terms of my speech today, I'm going to do two quick facets. One is: I'm going to cover some issues around, or principles around, resource allocation, and perhaps give you some direction on where you can go into the literature to pick some of that material up. But probably more importantly, I want to talk about a regional perspective in terms of the Shark Bay Region, and how resource sharing fits within a total framework.

1. BACKGROUND TO RESOURCE ALLOCATION

Classic approaches to fisheries management include MSY, MSC, ESD, EBM, and whole other series of jargons. And, what we've tended to do over the years is move forward from individual fisheries, and move more into ecosystem risks and so on, particularly under the EPBC Act, where we're dealing with issues of protected species, as well as the impacts on fisheries on broader ecosystems. For those who want some background on that, have a look at our website – I encourage you to have a look at the website, which you've got on your, on your tag. There's a lot of literature there that you might find of some interest.

Clearly the Oceans Policy, as the previous speaker has said, is actually pushing towards a broader, if you like, view of the world; particularly in terms of not just the traditional fisheries sectors of indigenous, commercial, and recreational, but extending into the broader questions of mining, petroleum, shipping, conservation, protection of biodiversity, and so forth.

2. REALITIES OF TODAY'S FISHERIES MANAGEMENT

Before talking about sharing the fish, I just want to talk about some background, which I think is relevant when I get to the Shark Bay discussion: namely, fish stocks are not stable, technology, population growth in coastal communities, competing demands for fish, economic pressures and fleet overcapacity, political importance of tourism and recreational fishing, customary/artisanal fishing needs, and illegal fishing.

Fish stocks themselves are not particularly stable, and I think it's useful to keep that in mind, because of environmental perturbations and independencies between fisheries. Technology is impacting on increasing efficiency of all user groups harvesting fish. Population growth and coastal development continues to impact on the numbers of people fishing and fish productivity of adjacent waters.

Competing demands for fisheries resources continue to outstrip the productive capacity of the majority of the world's fish stocks. Economic pressures, especially the

* Presentation can be found at http://www.fish.wa.gov.au/docs/events/ShareFish/papers/pdf/presentations/Present-PeterRodgers.pdf

growing costs of energy and commodification of seafood in the world's markets, are leading to issues of fleet overcapacity, low financial returns, and cost price squeeze pressures for many of the world's commercial fishing fleets. This trend is being ably assisted by growth in aquaculture production.

The political importance of recreational fishing pursuits in tourism, relating to dependence with charter fishing, coastal inland businesses from fishing or passive use of fish stocks are increasing. Customary fishing needs of indigenous people and, increasingly, more numerous artisanal fishermen in terms of the requirement to address protein needs of all in many of the world's oceans have become a matter of greater policy priority. And of course, illegal fishing, especially between jurisdictions, has made the task of sustainable fisheries resource management even more difficult for many jurisdictions. This activity, in turn, can and does, destabilize existing fisheries management arrangements.

2.1 Key governments role in allocation

It's against this background of sustainable resource management, that this question of government's role in addressing this question of allocation is becoming increasingly clear - and a number of speakers have said so – that until you get to explicit shares, then you run the risk of growth in one sector or the other leading to overexploitation, and -without adjustment - unsustainable fisheries, and in practice that's what we're seeing in a number of jurisdictions. The allocation decision, for most fisheries, can't be made explicitly, but clearly for the major fisheries, explicit allocation is the key.

And the other issue is management of multiple sectors over time. I think we tend to be a bit static in the way we look at this question. There are awful and considerable trends impacting on fisheries and you need to be able to deal with it in a continuous spectrum. The realities of fisheries management are that it is complex, and we are making it more complex as we try to deal with more and more of the anomalies. An appropriate framework, as many have said, is a rights-based framework, but that doesn't mean to say you can't do a lot without a rights-based framework, and perhaps you'll see that when I move further into my talk.

2.2 Guiding principles for allocation

In terms of guiding principles for allocation – I'll spend a little time on this, because there's been a lot of work done in Australia by Justice Toohey and the Coolangatta Communiqué also provides a good insight, at least I want to take the time to look him upon the website and, at least, go through them. The guiding principles are fairly basic:

- Intergenerational benefits - fish resources are a common property resource managed by the government for the benefit of the present and future generations;
- Sustainability is paramount;
- Decisions must be made with the best available information, but you should not defer decisions, simply because you don't have that information;
- Harvest levels that incorporate total mortality are seen as important;
- Allocations to user groups should account for total mortality of the fishery resulting from the activities of each group, including by catch and mortality of released fish;
- Total harvest across all user groups should not exceed the prescribed harvest level; if this occurs, steps consistent with the impact of each user group should be taken to reduce that take to a level that does not compromise sustainability;
- Appropriate management structures and processes should be introduced to manage each user group within their prescribed allocation, and this should incorporate predetermined actions that are involved with that groups catch increases above their allocation; and

- Allocation decisions should aim to achieve the optimal benefit to the community from the use of fish stocks and take into account economic, social, cultural, environmental factors. (Now, this is a fairly simplistic view, but each society has its own values and objectives, and it's critical to understand those objectives and those values before you actually move down this path-line. Realistically, this takes time to achieve, and the implementation of these objectives is likely to be incremental over time.).

In addition, allocations for a group should generally be made on a proportional basis to account for natural variations in fish populations. This general principle should not preclude alternative arrangements in a fishery where priority access for a particular use, or groups, may be determined. There are a number of examples of that, and the classic in the Australian scene is the priority given to recreational fishers in Northern Territory in the take of barramundi. That's been a very clear policy decision by the government in achieving such an outcome.

In addition, management arrangements must provide users with the opportunities to access the allocation. There should be a limited capacity for transferring allocations unutilized by a sector for that sector's use in future years, provided that outcome does not affect resource sustainability, and this question of transferring allocations between sectors is raised by Peter Pearse.

These principles are quite broad, but they remain applicable in most of WA fisheries. The real challenge facing the department and the committee set up to deal with this work is to translate those principles into actuality. There will be a number of talks at this conference focused on the work being done on rock lobster and abalone and on the difficulties in getting the appropriate data to actually make decisions. The collection of data and the management of precise allocations is problematic in itself. It is expensive, and it requires fairly precise measurement.

2.3 How to define shares

In terms of defining shares, there's a range of traditional management approaches. If you put aside this question of explicit allocation, implicit allocation has already occurred. In every fishery which is exploited, the sectors invariably are taking certain percentage shares of the catch.

What we're trying to do is move to an explicit allocation and give better precision to management and change over time. That doesn't mean to say you can't address allocation; you can actually address it implicitly by applying tools like spatial closures, temporal closures, using management measures such as size limits and so on that actually give effect to management outcomes - which include resource sharing shifts.

I think it's useful to understand that, because clearly that happens on a regular basis. I guess one of the real challenges, as a previous speaker raised, is the question of taking a broader ecosystem approach. Tat is a real challenge. Perhaps by going through this example in relation to Shark Bay, we could put that into context.

3. A WESTERN AUSTRALIAN REGIONAL EXAMPLE

3.1 Characteristics

The area is called the Gascoyne. The Gascoyne Region is off Western Australia's Shark Bay. Its characteristics are: low resident population, you got two centers – Carnarvon and Denham, it's dry hinterland, pastoral mining area, World Heritage listed, and other features. It is a bay with hyper-salinity; it's an icon area and there are dolphins and dugongs of significance in the region; there are at least 8 fisheries (managed fisheries); and there are low environmental impacts from industrial development and agriculture in this region. There's significant visitation and tourism; much of the recreational activity in the area is actually driven by people coming from the metropolitan region and elsewhere around Western Australia and Australia.

Just to give you some perspectives, there's a crab fishery up there of five to six hundred tonnes. The multi-snapper fishery is an important fishery, and it's a managed fishery. Prawning is a significant industry in the area, along with scallops. The pictures provide you with some quick scenes; it's a very pristine and pleasant place to go. In terms of fisheries, the snapshot is that there are about 8 fisheries, and they are all managed fisheries in the sense of a limited entry framework. You have prawn, scallop and snapper fisheries; you have a beach seine fishery in certain parts; there's a crab fishery, a mackerel fishery, and an open wet line fishery; a charter industry that focuses on it, and of course, there's aquaculture development.

For those who don't know where Shark Bay is, that's it in terms of Western Australia. It's an area of about 14,000 square kilometres, the area which I'm talking about.

The prawn and scallop fishery, most of the fishing occurs in that area in terms of prawn fishery, these are permanent closure areas. There're a whole series closures and openings and so on aimed to maximize the catch. The Shark Bay snapper fishery has three stocks and areas, and the salient feature is that two of these are largely harvested by the recreational sector, while there's a commercial quota managed sector in the third area. A particular feature about the two recreational fisheries is that, in order to achieve sustainability because the stocks collapsed, we've had to introduce a tagging system for the recreational catch. The mackerel fishery is just wide open.

There is also a marine park. Each one of those blue areas represents special protection zones for seagrasses and the like. You have sanctuary areas, general use areas, and so on.

There is also a crab fishery. Crab operations are outside the area that serves as the nursery area for a lot of the crab fishery. There are aquaculture sites and pearling sites within Shark Bay. And when you impose a whole lot, you get what you call a real mess – and that's the reality. Fisheries management is done in terms of individual fisheries, and you have different particular measures on top of each other, and if you impose marine park, it's a fairly composite set of management arrangements aimed to ensure sustainability and which also has implications for resource sharing.

3.2 Key fishery management issues

I just want to reflect on some of the issues which are going on. These include a marine park with multiple use areas in the lower half of Shark Bay, and there's separation between take and no take. There are significant intra-sectoral sharing issues in the commercial fisheries between scallop and prawns, snapper and other species, beach seine and crab, snapper and wet line. There are significant intersectoral sharing issues between commercial, charter, and recreational, snapper and wet line fishing operations, and to a lesser extent, crabs. There are stocks issues for tiger prawns and snapper. And you manage the whole lot as a composite set.

So what are some of the trends impacting on the fishery? Well there is the long term cost price squeeze that I mentioned before; there's growing tourism and, in particular, recreational fishing due to visitations to Carnarvon, Denham and Monkey Mia. There's expanding salt mining in the lower reaches of Shark Bay. There are resource management planning issues around protected species such as dolphins and dugongs. There is spatial separation of fishing. There's total protection of shark stocks in the area in terms of no netting, although that's really aimed at protecting the dugongs. And, of course, there is the World Heritage listing.

So you make a series of decisions in terms of who uses what area and what type of gear, all aimed at really optimizing, - not necessarily maximizing, but optimizing - the total take, and trying to minimize the interaction between and within groups. That's the normal process.

3.3 Within sector resource sharing issues

Briefly, there is the effort regulation between the prawn and scallop fleets. We have two fleets, I'm sorry we ever go to that point, but we have got to that point, and so you have this interaction which you have to manage. We'd be much better if there was just one fleet.

There's merging of management approaches for demersal finfish and snapper. Obviously, we put snapper management in place, but it has become terrifically, abundantly clear that we couldn't sustain the wet line fishery unless we moved that to quota management, or some form of management, along with snapper – and that's under way. There are spatial and time closures to protect snapper stocks from trawling, and we've had to put those in place so the two fisheries didn't interact from the point of view of sustainability.

We have gear controls – bycatch reduction devices (BRDs) to minimize interactions with turtles and bycatch. Also, there are gear controls (no shark netting, for example) and area closures to trawling to protect nursery areas, seagrass meadows, dugongs and dolphin interactions.

We have had quota reductions in snapper due to resource sustainability. We've had voluntary buyback schemes, in place to actually deal with improving profitability of the prawn and beach seine fisheries. We've had internal fleet size adjustments by unitizing gear in the Shark Bay prawn fleet, again, to improve the profitability of the industry.

3.4 Across sector resource sharing issues

We have clear limits on the recreational catches in the commercial quota and recreational line fisheries, particularly for the inner stocks of snapper in Shark Bay through tag issues, as I mentioned, in the Freycinet Inlet and Eastern Gulf.

We have spatial separation of crabs and snapper fishing activity between recreational and commercial fisheries and, to some extent, through closures and management zoning inshore. Also there are different sizes regulations for crabs: the commercial crab fishery in the top end of Shark Bay targets a size limit of about 135cm, compared with a recreational size limit of 127cm.

There's voluntary reduction and spatial separation of beach seine effort, and that's slowly progressing. (I can remember when there were 21 boats in the fishery, now we're less than 9 active vessels in the fishery, and they're voluntarily putting in spatial separation, because they don't want to have any interaction with recreational fisherman.)

There's a range of multiple use zones within marine parks impacting on management of boats, fishing, and non fishing or sanctuaries to meet Shark Bay marine planning outcomes and to ensure the biodiversity values of the Shark Bay region are met.

So, we have precise management of demersal finfish stocks progressing with the snapper fishery. Eventually, there will be an establishment of some resource allocation as the percentage take for oceanic demersal finfish fishery, and that's particularly likely to occur with increasing recreational tourism in the area.

There's potential market adjustment, as one of the other mechanisms we need to think about in terms of commercial and recreational catch, because the real key issue in terms of this is resource security. It's resource security from the point of view of the resource itself, the sustainability aspects – but it's resource security in terms of the players, particularly as an investment and business decision. And, I think we will see some further spatial separation of beach seine fishing as we go into the future.

4. LONGER TERM DIRECTIONS FOR THE MULTI-SECTOR, MULTI-FISHERY REGION

What it's leading to, I think, is that we can take a more sophisticated approach to resource management between sectors. Clearly, in the big sectors, and I'm talking

about the big fisheries – explicit allocation is possible. In the minor sectors, it's not cost-effective. The resources required to actually get down to fine-tuning a resource allocation in some of those minor fisheries is just not practical or possible.

But you can use tools such as making a fishery a single user fishery – that's possible. And it's realistic in terms of management options. And, even in making decisions about crabs, one has to take on board that most of the metropolitan take of crabs is by recreational fishing, whereas up in this region, most of the take is by the commercial industry. So, you may want to take a state-wide perspective in planning around future uses of fish and where it might lead you to.

In conclusion, I think fish use planning needs to become an explicit tool as a planning function. And if you look at a bioregion, you can certainly take a perspective which deals with explicit allocation for some fisheries, spatial separation for other fisheries, the single use of a fishery by one sector, clear marine planning requirements being met by closures and other things in terms of meeting biodiversity. And if you sit down and think about growth in population, think about changes in technology, think about trends in economic performance and so on, you can provide pretty good answers about where things might be in a decade's time.

If at the same time, you can actually define how you might facilitate adjustment between sectors, then I think you can give greater certainty to the commercial fishing industry, as well as others, in terms of how you might deal with the future.

A myriad of approaches are available in terms of resource sharing, and while I'm a great believer in explicit allocation for the larger fisheries, I am not convinced for many of the minor fisheries that it's a worthwhile task.

Thank you.

Allocation issues in marine environment: managing conflicts between commercial, artisanal and tourism in tropical fisheries

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ABSTRACT

Allocation of resource access and use rights is one of the most controversial issues in marine fisheries. Historically, various principles of allocation have evolved along with the objectives of public policies (such as concerns for sustainability and poverty alleviation), and recognition of different stakeholders in fishing industry. The recognition of exclusive economic zones (EEZ), development of technologies, and emergence of markets for different products, services and uses of fisheries and the marine environment provided an overall economic dimension to the allocation issues. Recognition of tourism, recreational fishing, conservation and bio-diversity values of fisheries have a recent and important influence on the allocation principles in fisheries. As a result, allocation issues in tropical fisheries have become elevated from concerns for improving and maintaining the welfare and living standards of small isolated fishing communities to a higher level cross-sectoral, national, and international development and conservation concerns.

This paper examines the conflicts and competition among artisanal, commercial, and tourism with regard to allocation of marine resources. The effectiveness and limitations of market-based allocation principles as well as common property and co-management arrangements to manage resource conflicts are discussed. The implications of replacing conventional hierarchical and command-and-control policies by moving towards greater decentralization, whether through markets, common property, or co-management, on existing resource allocation are also discussed. Both vertical and horizontal approaches to the management of the industry have been recommended to manage the allocation issues in socially, economically and environmentally sustainable ways.

1. INTRODUCTION

The allocation of resource access and use rights is one of the most controversial issues in marine fisheries ever since mankind begun to fish in the seas, rivers and oceans, and even before public policies emerged to deal with the fisheries management. Although economists refer to allocation as an economic criterion for ensuring efficiency in the production and use of a resource, historically, various principles of allocation have evolved in response to the changing objectives of public policies (such as concerns for sustainability, improving economic efficiency, and poverty alleviation) and recognition

of different stakeholders in the fishing industry. The history of commercialization of tropical fisheries is a recent one since for decades fishing for food and local livelihoods were the main motivation behind coastal communities seeking allocation or rights over sea space and sea resources. On the other hand, commercial interest in tropical fisheries did not stay confined in intensive harvesting of fish alone. Recreational fisheries, tourism, and resort services are few of the modern forms of uses of fisheries, which have the dimension of allocation over space, time, and efficiency.

This paper examines the conflicts and competition among artisanal, commercial, and tourism with regard to allocation of marine resources. The effectiveness and limitations of market-based allocation principles as well as common property and co-management arrangements to manage resource conflicts are discussed. The implications of replacing conventional hierarchical and command-and-control policies by moving towards greater decentralization, whether through markets, common property, or co-management, on existing resource allocation are also discussed. Both vertical and horizontal approaches to the management of the industry have been recommended to manage the allocation issues in socially, economically and environmentally sustainable ways.

2. EVOLUTION OF FISHERIES ALLOCATION PRINCIPLES

There were times when fishing was a way of life and part of traditional food and livelihood strategies in coastal communities. The issue of allocation at that time focused primarily on the communal use and access to the resources, which was mostly governed by traditional allocation principles, such as indigenous people's rights, and customary allocation of fishing rights over coastal and near-shore areas, coral reefs, islands and beaches. The creation of nation states that somewhat redefined many pre-existing traditional property rights, and state control over fisheries and coastal waters are relatively recent phenomena. However, their influence was instrumental in the development and design of formal principles of allocation in marine and coastal waters. While technological revolution hastened the growth of industrial fisheries, market demand and fishery characteristics contributed to further subdividing fisheries along species, gear use and fishing scale. The emergence of international policy regimes, such as the creation of EEZs, United Nations Convention on the Law of the Seas (UNCLOS) and several other international agreements and conventions that followed in the last two decades have also reshaped the fisheries and ocean management across developed and developing countries. This is also the period when a huge influence of value added and service oriented activities in coastal and marine waters, such as recreational fishing and tourism, were observed on the allocation of resources in fisheries, and many of the complex management conflicts ensued.

The early development of the fisheries industry during the 1950s through the 1960s was governed by the principle of "freedom of the seas," where unrestricted use of the sea's unlimited potential outside the territorial waters of a state's three-mile territorial limit was provided with minimal regulations on offenses (see Table 1). This reflects the allocation principle of open access, which is characteristic of this period where marine resources were perceived as inexhaustible. Table 2 summarizes the influence of major global policies and institutions on national and local allocation at different time periods.

The 1970s through the early 1980s saw coastal states declaring EEZs up to 200 nautical miles, which increased territories under national jurisdiction. Also at this time, the pursuit for economic growth and revenue generation from export trade, coupled with the expansion of fishing capacity from improvements in harvesting technology and methods led coastal nations to develop their national fishing industries, resulting in a phenomenal increase in the scale of fishing activities worldwide and the accompanying accrual of substantial short-term monetary gains to those who participated in the global fish trade (Bennett, 2000). Unfortunately, this development route resulted in the

dissipation of resource rent in the longer term, leading to problems of overfishing in a number of important fish stocks by the end of the 1970s, and consequently, escalating persistent conflicts between subsistence and commercial fishers as national policies continued to advocate for increased export receipts and started renting fishing areas to distant water fleets (Payoyo, 1994; Bennett, 2000, Kearney, 2001).

TABLE 1
Evolution of fisheries allocation paradigm

	Time period			
	1950s to 1960s	**1970s to early 1980s**	**Mid-1980s to early 1990s**	**Mid-1990s to present**
Dominant Paradigm	Freedom of the seas	Rationalization	Sustainable development	Conservation and social welfare paradigm
Allocation Principles	Open access	Sustainable yield & efficiency (MSY, MEY)	Environmental sustainability	Ecosystem health and biodiversity conservation Multiple social and economic benefits
Management Regime	Development management	Territorial Use Rights of Fisheries (TURFs) Centralized command and control	Monitoring Control & Surveillance (MCS) Integrated Coastal Management (ICM) Rights-based fisheries management	Multiple use and user approach Marine Protected Areas (MPAs) Community-based management Co-management

Source: Adapted from Ahmed *et al.*, 2005.

TABLE 2
Influence of global policy and institutions on national and local allocation at different time periods[144]

	Time period			
	1950s to 1960s	**1970s to early 1980s**	**Mid-1980s to early 1990s**	**Mid-1990s to present**
Global Policies & Institutions	Freedom of the Seas	EEZs, UNCLOS, common heritage of mankind	· Brundtland Report · CITES	· Trade liberalization (e.g. WTO) · CCRF-FAO · MDG, WSSD, CBD
National Response	Open Access	· Expansion of coastal states jurisdiction · Joint venture license agreements · Fleet modernization · MCS systems · Aquaculture revolution · Introduction of Western stock assessment & management techniques	Coastal land use planning; Fishing zone; Gear regulations by fishing scale and use category · Fisheries sector review (e.g., Philippines Fisheries Sector Program-World Bank)	· Updating of national fisheries development plan (e.g. 1997 Agriculture & Fisheries Modernization Act, 1998 Philippines Fisheries Code, Cambodia's National Fishery Law) · Tariff reduction
Local Response	Open access	· Increased fishing effort · Mangrove conversion to fishponds · Privatization	Fisheries infrastructure development (e.g. National Milkfish Breeding Program, Philippines)	· CBFM (Bangladesh) · Decentralization (Philippines, Indonesia) · Fishery management council (informal) · Community fisheries (Cambodia)

Source: adapted from Ahmed *et al.*, 2005.

[144] Note: CBD – Convention on Biological Diversity; CBFM-Bangladesh – Community-based fisheries management; CCRF-FAO – Code of Conduct for Responsible Fisheries; CITES - Convention on International Trade in Endangered Species of Wild Flora and Fauna; MDG – Millennium Development Goals; WSSD – World Summit on Sustainable Development.

The signing of the United Nations Convention on the Law of the Sea (UNCLOS) on December 10, 1982 in Montego Bay, Jamaica by 117 countries ushered a new paradigm on the world's oceans as "the common heritage of mankind." Thus, exploitation of mineral on the ocean floor beneath the high seas were now considered global jurisdiction rather than under national authority. In addition, full sovereignty of coastal states subject to the right of innocent passage for foreign ships was extended from three to twelve nautical miles. Moreover, the establishment of exclusive economic zones (EEZs) increased the ocean resources of those countries where they were granted exclusive rights to the fish and marine life in waters within 200 nautical miles from the baseline and gave them exclusive management and usufructory rights over these resources for economic development (Hinds 2003). The recognition of exclusive economic zones (EEZs), development of technologies, and emergence of markets for various marine products provided an overall economic dimension to the allocation issues based on conservation of the resource stocks.

In 1987, the guiding principles of sustainable development were laid down in the Brundtland Report by the World Commission on Environment and Development (WCED). With this, allocation issues took a new dimension to include the environmental consequences of aquatic-related activities as the intergenerational aspects of economic growth came into fore. In order to assure not only the short-term but also the long-term capacity of the future generation to meet their needs, sustainable development strategies called for a balance between the pursuit of economic growth and the protection of the natural resource stock.

By the 1990s, increased competition from non-fisheries users of the aquatic environment began to surface as other stakeholders of the ocean (e.g. tourism, recreational fishing, etc.), often with diverging socio-economic goals began to assert their rights. This implies that allocation issues were no longer exclusive to the fisheries sector and that any allocation decision will now have to account for the multi-uses of the ocean.

Among the poor, declining socio-economic opportunities brought about by poverty, lack of alternative employment in the non-fisheries sector, and landlessness made fishing the only remaining alternative for food, nourishment, and income, increasing fishing pressure and conflict among subsistence fishers (Salayo *et al.*, 2005b). This led governments around the world to commit to poverty reduction as one of their goals of the new millennium, which has equity implications in the allocation of resources.

On the global scene, while globalization opened new opportunities for increased production and trade, local coastal villages often found themselves unable to compete and in the losing end as they limit or lose control and access over fishery resources, which traditionally were accessible to everyone (Viswanathan *et al.*, 2003; Salayo *et al.*, 2005b). At the national level, the devolution of central government control provided local governments with a direct hand in managing resources. This has helped some of the states in Asia and Africa to revitalize participatory resource management strategies (e.g. co-management and community-based management) because the prevailing centralized, top-down management strategy for fishery resource failed to respond to the needs and issues faced by local coastal communities. Clearly, allocation issues in tropical fisheries have become elevated from concerns for improving and maintaining the welfare and living standards of small isolated fishing communities to a higher level cross-sectoral, national, and international development and conservation concerns.

3. FISHERIES ALLOCATION AND CONFLICTS UNDER DIFFERENT MANAGEMENT REGIMES

3.1 Types of management regimes and allocation principles

3.1.1 Traditional fishery management

Customary or indigenous institutional fisheries management involves community ownership of coastal resources and collective fishing rights to allocate, use, manage,

TABLE 3
Fisheries management and allocation and their response to conflicts

Management regime	Allocation principle	Response to conflict	
		Type of conflict created	Type of conflict resolved
Traditional	Open access; common property	Resource sustainability	Social tension between fishers (conflict on relations)
Centralized/Top-down	Conservation of resource stock	Social tension across scale of fisheries (e.g. small-scale vs. large-scale fishers)	Resource sustainability of selected fish stocks
Decentralized/Bottom-up	Ecological/ environmental considerations Intergenerational equity · Multiple use	Social tension between managers and users of the resource (e.g. marine users vs. government authorities/fisheries administrators)	Resource sustainability Social tension due to inclusion of local community/ resource users in the management process Intergenerational equity Multiple-use

and control fishery resources mainly for subsistence, based on cultural traditions and values that are generally marked by a sense of harmony with the ocean, and that is effected through kinship or similar arrangements within the respective indigenous group (Payoyo, 1994; Adams and Dalzell, 1995). Access to the near shore fishery resources is determined through several mechanisms, such as proximity of a coastal village to the fishery area, as in the case of the Micronesian islands. Beyond this exclusive zone, other fishers are allowed to harvest with the understanding that the privilege to fish in the area is a token of the island community's hospitality and generosity and that preferential rights to the fishing grounds belong to the adjacent village. Thus, any catch that is considered to be excessive is to be returned to the local chief, who will then determine their share in the catch (Nakayama and Ramp, 1974). Table 3 shows examples of conflicts that were resolved under different management/ allocation regimes, while creating new ones.

Because fishery resources were abundant and a sizeable proportion of the local village population has a direct stake in maintaining the health of the marine resource as a food source, overfishing was not a problem. Also, effective monitoring of fishing activities was easily carried out in indigenous fishing communities where everybody knows one another and where the village chief is always kept abreast with the latest developments in the community. As a result, conflicts were limited mostly to problems on boundaries of fishing grounds, which were settled through an established tradition of mediation and retribution (e.g. loss of face or standing) with nominal use of institutions (Adams and Dalzell, 1995).

For years, community access rules to manage common property was effectively handled by traditional systems. This is supported by a number of fairly recent studies on coastal communities (e.g. Hviding and Jul-Larsen, 1993; Ruddle, 1994; Dyer and McGoodwin, 1994) that show that given certain conditions (e.g. relatively small group with common needs and norms, clearly defined boundaries for resource management, strong leadership, relatively low cost of enforcement, etc.), informal management systems can effectively promote and enforce sustainable use of fishery resources (Pomeroy, 1995; Adger and Luttrell, 2000). This further implies that the social benefits of working together as a community towards a common goal of protecting the right to fishery resources outweighed any net gains in private utility from individual profit (Bennett, 2000). However, as markets began to permeate the economy, such that vertical integration of exchange replaced the prevalent horizontal structure of transactions, customary institutions of artisanal fishery management based on communal usufructory rights became inadequate in handling the pressures and the accompanying problems brought about by the growth of a market economy (Payoyo,

1994). Thus, governments began to intervene by limiting access to marine resources in an effort to protect the welfare of local fishing communities and accommodate the growing pressure from the commercial interests.

3.1.2 Centralized fishery management

Centralized fisheries management followed from the early phase of expansion of fishing in prevailing open access in the 1960s. As pressures from commercialization and industrialization began to impact on marine resources, governments around the industrialized world started to intervene in the management of fishery resources in an effort to control fish harvest (Kearney, 2001). This centralized approach to fisheries management drew largely from the biological models of maximum sustainable yield of selected fish species that has been proven to have limited use in multispecies tropical and subtropical fisheries (Pomeroy, 1996; Bennett, 2000). Nevertheless, the focus of this conventional science-based management framework is in controlling fishing effort in order to achieve a particular level of harvest and fish stock (SIFAR/FAO, 2003). Indirect controls were first imposed through regulations (e.g. shorter fishing period, restrictions on fishing areas, limits on allowable harvestable fish size, regulations and restrictions on the use of gear, boat length, and equipment, use of licenses, etc.), which proved ineffective as fishers devised creative ways to circumvent these regulations (Kearney, 2001; Jones and Bixby, 2003). For example, as the fishing season became shorter, the fishing crew became larger; as restrictions on boat length were imposed, boats with wider and deeper hulls were introduced (Jones and Bixby, 2003). In effect, these regulations were only effective during the transition period from its imposition until such time that resource users and/or technology have crafted ways to outwit the regulation (Jones and Bixby, 2003).

Because of the poor incentive structure of indirect controls to address resource use and allocation, a shift in fishery management based on the control of market forces and private ownership through the allocation of property rights gained increasing popularity in industrialized and sub-tropical fisheries (Bennett, 2000; Kearney, 2001; Jones and Bixby, 2003). Rights management or direct control on the number of fish caught was implemented mainly through individual, transferable quotas (ITQs), which confers property rights to the fish prior to harvest by providing license holders a share of the total allowable catch (TAC)[145] (Bennett, 2000; Jones and Bixby, 2003). ITQs have been identified as the dominant factor responsible for the success of commercial fisheries in New Zealand and Australia, primarily because by providing each license holder with a secure assurance of a portion of the fishery resource (TAC), competition in maximizing the catch is eliminated with an effective enforcement mechanism. This implies the following:

a. ITQs reduce inefficient capitalization and increase profitability because fishers are able to concentrate solely on maximizing profits by improving the value of their catch and reducing costs instead of maximizing their catch;
b. ITQs help fishers command a higher price for their product by allowing them to spend more time in marketing;
c. ITQs is a more effective conservation method (as opposed to indirect controls) since it provides fishers a direct stake and the fishery and because ITQs are directly determined by the value of the fishery;
d. ITQs can reduce subsidy to fisheries since the more efficient fishers can buy individual shares from the less efficient fishers; and
e. ITQs provide a market mechanism to settle conflicts among various resource users through the exchange of quota shares.

[145] The quantity of fish that can be sustainably harvested in a season, as determined by biologists (Jones and Bixby, 2003).

In general, although fisheries management worldwide is predominantly run by government, experience to date shows the inability of centralized institutions in effectively addressing the fundamental internal and external pressures to the marine environment that affect fishing communities (e.g. competing uses, rising population, globalization, and environmental degradation) and in successfully achieving its conservation objectives, which have a narrow focus on the sustainability of the fish stock (Pomeroy, 1995; Viswanathan *et al.*, 2003; Nielsen *et al.*, 2004). Worldwide evidence show continued overfishing of several important fish species and the threat of extinction for some of these stocks even as modern fisheries management has been in place for decades (Viswanathan *et al.*, 2003; Nielsen *et al.*, 2004).

This has been traced largely to the exclusive use of biological models as basis for decision-making, the manner in which the objectives are defined, and more importantly, the lack or absence of input and participation of stakeholders from the local community in the management process, which in turn reduced its authority and usefulness as a governance structure (Pomeroy, 1995; Hara and Nielsen, 2002; Viswanathan *et al.*, 2003; Nielsen *et al.*, 2004). As a result, the recent decade has seen a revitalization of fishery management effort towards increased decentralization and active participation of coastal communities.

3.1.3 Decentralized fishery management

There is a growing trend towards decentralized bottom up or shared responsibility between government and local communities in the management of marine resources (e.g., co-management, community-based management) as evidenced by partnerships established by the national and local governments with industry, NGOs, fishing communities, and local resource users in carrying out programs and policies, and in the delegation of responsibilities between them (Nielsen *et al.*, 2004). Because local communities and resource users are provided a voice in the decision-making process and are actively involved in resource management, and because it provides a mechanism to strengthen the interaction between resource users and managers, bottom-up management broadens the information and knowledge base on which decisions are made, increases acceptability and compliance of regulations, reduces transactions costs of control, monitoring and enforcement, improves the efficacy of governance, and provides a more effective alternative to conflict resolution (Pomeroy and Williams, 1994; White *et al.*, 1994; Sandersen and Koester, 2000; Bennett *et al.*, 2004; Vedsmand and Raakjaer Nilsen, 1995; Nielsen, 2004; Nielsen, n.d). Moreover, supporters of this type arrangement have highlighted the fact that conflict can act as the catalyst for community groups and resource users to become actively involved in co-management/community-based management and thus, play an important role in conflict resolution (Nielsen, 2004). For example, co-management in Mozambique and the Philippines was prompted by conflicts over the type of fishing gear between small-scale fishers needing protection from industrial fishers; in the Laos, Malawi, Thailand, and Zambia, co-management was seen as a mechanism to exclude outsiders' access to fishery resources (Nielsen, 2004).

On the downside however, bottom-up approach to resource allocation involves various user groups and hence may be more time consuming compared to the centralized strategy (Vedsmand and Nilsen, 1995; Nielsen, n.d.). In addition, the bottom-up approach may not be suitable in a number of situations, such as when stakeholders do not have the capacity or willingness to manage the resource (Vedsmand and Raakjaer Nilsen, 1995; Nielsen, n.d.). Moreover, the relinquishment of authority from centralized control may be fraught with resistance by fishery administration who may be non-supportive of the transition towards decentralized management of fishery resources (Nielsen, n.d.).

TABLE 4
Examples of prevailing fisheries conflicts: Philippines, Thailand and India

Typology of conflicts	Philippines	Thailand	India
Type 1: Who controls the fishery (access issues)	Small-scale fishers vs. commercial fishers and fishery regulatory bodies over zoning of fishing grounds to delineate access by category of fishers	Large vs. small-scale fishers over rights and access to designated zones by type of fishery and use of light luring and modern fishing gears by large scale fishers	Traditional vs. mechanized fishers who venture in 8 km inshore waters allocated for traditional fishers
Type 2: How are the fisheries controlled	Small-scale fishers vs. commercial fishers and sea patrols over variable levels of patrolling and enforcement of the latter that favour commercial fishers who can afford penalties	Commercial trawlers, push netters, vs. regulatory agencies over lack of enforcement to control the number of fishing vessels and limit entry and operation of destructive gears	Fishers vs. state government on mesh size regulation
Type 3: Relations between the fishery users (linguistic, religion, ethnic, scale of fishing)	Local artisanal vs. migrant commercial fishermen over access and competition on fishing zones	Rivalry between resident small-scale vs. migrant large-scale anchovy fishers over legitimacy of access and destruction of gears	Traditional fishers complain over use of ring seines by mechanized fishers
Type 4: Relations between fishers and other users of the aquatic environment (fishing vs. tourism and similar water resource-based industries)	Fishery and sectors such as tourism, navigation/ docking, sand quarrying and mariculture over varying use of aquatic resources	Rice farmers vs. prawn breeders over resource use	Traditional vs. mechanized fishers and hatchery operators over collection of prawn brooders ·Fishers vs. government and industries on discharge of effluents; also tourism
Type 5: Relationship between fishers and non-fishery issues	Fishers vs. government authorities over variable standards in management and enforcement arising from devolution of functions and overlapping institutional structures	Fishers vs. government authorities over lack of proper management and enforcement	Fishers vs. government on overlapping functions of agencies and weak structure at various government levels

Sources: [1] Bennett, *et al.*, 2001; [2] Siason, *et al.*, 2004; [3] Nissapa, *et al.*, 2004.

3.2 Typology of conflicts among resource user groups

Conflict among the multiple users of tropical fishery resources have never been more pronounced as today. This stems largely from strong and mounting pressure on a rapidly dwindling resource base from a rising population, changing consumer preference towards fish and fish products, globalization, competition from coastal zone development (e.g., tourism, housing, infrastructure, aquaculture, agriculture, etc.), increasing fishing effort and number of fishers. Below we discuss three cases of conflicts representing Philippines, Thailand and India. In the Philippines the conflicts relate to zoning regulations allocating access for small scale and commercial fishers in the Visayan Sea, which typifies the conflict of who controls the fishery (i.e., access issues) (Bennett *et al.*, 2001). In the case of Thailand the main conflict was over gear use between small-scale fishers and commercial anchovy fishers in southern Thailand, and characterizes conflict on relations between fishery users (e.g. linguistic, religion, ethnic, scale of fishing, etc.). In the case of India, conflicts originated from the state-government led implementation of Tamil Nadu Marine Fisheries Act 1983 that created separate zones for each of the dominant type of fishing (see Table 4).

3.2.1 Philippines – small-scale municipal fisheries versus large-scale trawl fisheries

Republic Act (RA) 8550 is a zoning regulation that restricts fishing activities of commercial fishers to waters beyond 15 kilometres from the municipality's coastline. However, certain actions by the government authority, and perceptions among competing groups increased the level of conflicts rather than resolve them. Salayao

et al. (2005a) observed that commercial fishers are allowed to access to municipal waters within 10–15 kilometres from the shoreline in Concepcion, Iloilo, Philippines for a rental fee of P2,500 (approximately US$50) per 2 weeks). The commercial fishers view that preferential treatment has been given to municipal fishers since the best fishing grounds are within the seven kilometres from the shoreline in Concepcion, Iloilo, whereas it is the commercial fishers who pay taxes and license fees. As a result, non-violent conflicts between the municipal and commercial fishers usually due to collision of smaller municipal fisher boats with the larger commercial vessels have increased since the promulgation of RA 8550 (Siason *et al.*, 2004).

3.2.2 Thailand – gear conflict versus weak enforcement of zoning regulations

The long-standing conflicts in Songkhla Province, Thailand, can be traced to the (a) difference in the type of gear used by local small-scale fishers and those used migrant large-scale anchovy fishers (i.e. light luring falling net vs. traditional fishing gear; small-scale light luring falling net vs. large-scale light luring fishing net; light luring falling net vs. light luring purse seine; and trawl vs. traditional fishing gear); (b) entry of non-local fishing boats in local waters; and (c) use of better fishing technology by migrant fishers. Although there were regulations on zoning and restrictions on use of fishing gears, poor enforcement by government authorities prompted both local and migrant fishers to break the law. In the end, local fishers and the local community lost out in the competition for access to fishery resources, which resulted in a reduction in fish stocks by 50 to 70 in the area (Nissapa *et al.*, 2004).

3.2.3 India – Tamil Nadu State Fisheries Act 1983 versus fishing practices

In the study sites in India Salayo *et al.* (2005) identified the key conflicts that arose from the resource sharing and indiscriminate fishing practices of the rival groups of fishers. Specifically, conflicts were due to use of smaller mesh-sized nets, trawling in breeding grounds, and weak marketing structure. The use of mechanized boats encroaching in areas allocated for traditional fishers was one of the most common conflicts not only in the study area, but also in adjoining fishing areas. The dispute was being linked to state government-led implementation of the Tamil Nadu Marine Fisheries Regulation Act 1983 aimed at curbing the excess capacity of mechanized fishing boats by creating separate fishing zones for the three sub-sectors. In the nearby Kerala State disputes arose from the imposition of closed fishing season which the fishers believe are ill-advised and lacking scientific basis.

The above examples show that while weak enforcement of regulations can be cause severe resource conflicts, attempts to enforce regulations targeting one user group or sector can also create an increased level of tensions and conflicts, especially when the desired results of such regulations remain at large. As a consequence regulations themselves are linked to the conflicts among fishery stakeholders, including conflicts between fishers and government officers who are perceived as not rightfully implementing the enacted regulations. Conflicts also arise from polluting effluent discharges and oil spills from various industries in the vicinity. Tourism and the gathering of shrimp brooders for the growing hatchery business in Tamil Nadu were also noted as cause of conflict between these industries and traditional fishers (Salayo *et al.*, 2005).

3.3 Conflict resolution instruments under alternative management regime

Instruments and reform measures to resolve conflicts vary across typology of conflicts and management regime (Table 5). For example conflicts arising from who controls the fishery can be resolved by traditional mediation in the case of traditional management. On the other hand, regulatory enforcement of access rights is a popular instrument for this type of conflict when fisheries are managed through central controls,

TABLE 5
Conflict resolution instruments and reforms under alternative management regime

Typology of conflict	Management regime	Management instrument
1) Who controls the fishery	Traditional	Traditional claims/preferential rights
		Conflict settlement through tradition of mediation and retribution
2) How are fisheries controlled		Collective fishing rights based on cultural traditions/values
		Direct dialogue between various parties
		Community policing–Chieftain tradition (Ghana, Africa)
3) Relations between fishery users		Inter-village disputes settlement through negotiations among village chiefs
4) Relations between fishers and other users		Inter-village disputes settlement through negotiations among village chiefs
5) Relations between fishery and non-fishery		Council of Elders
1) Who controls the fishery	Centralized	Zoning regulation (Republic Act 8850, Philippines) – municipal vs. commercial
2) How are fisheries controlled		Indirect controls/rights management on fishing effort
		Direct controls on catch limit (ITQs – New Zealand)
3) Relations between fishery users		Indirect controls on fishing effort
4) Relations between fishers and other users		Recreational regulations – bag and size limits, method and gear restrictions, closed areas and closed seasons (Australia)
5) Relations between fishery and non-fishery		Use of industry liaison for arbitration
		Monitoring and enforcement of fisheries regulations, public strategic policy, and economic planning usually based in government agencies
1) Who controls the fishery	Decentralized	Zoning agreement based on sustainable use, integrated and co-management of the marine resource and multiple use (Caribbean)
2) How are fisheries controlled		Social inclusion and industrial organization
		Amicable settlement through payment of damages (Philippines)
		Rational harvesting between scallop and oyster (New Zealand)
		Build non-fishery capacity and alternative livelihood
3) Relations between fishery users		Community-Based Fisheries Management Programme operating hand-in-hand with the traditional institution (Ghana, Africa)
4) Relations between fishers and other users		Establishment of MPAs (Sulawesi Sea) –small scale vs. tourists
		Information, education, and communication to create and enhance awareness
5) Relations between fishery and non-fishery		Industrial organization (i.e., power sharing and balanced fisheries management)
		Empowering co-management (i.e., empowerment of fishing communities)

Source: Salayo *et al.*, 2005a.

although weakness in the surveillance and enforcement capacity couple with high management cost has made this instrument ineffective in resolving conflicts. The same can, however, be accomplished at a reduced transaction cost through decentralized and participatory managements such as co-management. Often, co-management and participatory management has to rely on integration of management with exit strategy and rehabilitation measures (Table 6).

In the case of Philippines, effective monitoring and enforcement of RA 8550 had expected to result in the exit of some municipal commercial fishers from some parts of the country (Table 6). Alternative livelihood options have been explored in order to reduce the pressure on the already overfished marine area. Moreover, the provision of educational opportunities primarily to the children of fishers may reduce the entry of new fishers into fisheries since fishing is often seen as an early employment outlet for those who couldn't afford to go to school (Siason *et al.*, 2004).

For Songkhla Province, Thailand, small scale fishers were willing to compromise with the larger scale anchovy fishers by working part-time in processing anchovies in order to augment their income and manage the conflict. At the same time, they sought the assistance and support of local government officials and worked with academics and non-government organization (NGOs) in obtaining information and advice about the situation (Nissapa *et al.*, 2004).

TABLE 6
Examples of Management Options to Fisheries Conflicts: Philippines and Thailand

Country	Management options
Philippines	·Limit new entrants ·Review provisions on zoning ·Alternative livelihood options
Thailand	·Fishing zones ·Promote community-based management ·Limit fishing effort (improved licensing system)

Source: Salayo *et al.*, 2005b.

In terms of policy measures, majority of stakeholders in Thailand agreed that zoning of fishing grounds could be an effective measure in minimizing the conflict and rehabilitating the fishery stock in the area by protecting particular areas from encroachment and guaranteeing poorer stakeholders privilege rights on selected fishing grounds. In addition, government control on the use of destructive fishing gear should also be promoted through improved licensing. Moreover, while of local community rights in resource management has been recognized, regulations that explicitly include the role of fishing communities in the management process of the aquatic environment and its resources should be promulgated (Nissapa *et al.*, 2004).

4. FISHING-TOURISM INTERACTIONS - ALLOCATION ISSUES AND EMERGING CONFLICTS

The coastal fisheries resources available to many countries no longer constitute just a source of food and income, but also an important tourist attraction, which in itself is a huge global industry. The concept of ecotourism in marine environment centers around the use of coastal resources for water sports, such as swimming and diving, and the recreational interest over fish, coral reefs, and other underwater resources. Sport fishing and diving are gaining increasing importance for tourism. Tourism uses can be beneficial, for instance, game fishing generates substantial revenues and is selective, while for many reef-dependent species, localized fishing sanctuaries can help reduce conflicts between user groups.

Coral reefs are an important part of the growing tourism industry. Corals are living organisms that contribute to fisheries in a number of ways: (a) reef fishing itself; (b) fishing in shallow coastal waters where the reef forms an essential part of the food web; and (c) offshore fisheries which depend in part on the reef's productivity. It has been estimated that one-third of the world's fish species live on coral reefs (WRI, 1986). Many artisanal fisheries also depend on coral reefs. Such fisheries represent 90 percent of fish production in Indonesia and 55 percent in the Philippines (Clark, 1992). Hence, there tends to be a high level of conflict over coral reef usage, especially between fishing, tourism, and coral mining. The issue of carrying capacity is a major management concern in all these usages. Clearly, coral mining leads directly to physical degradation as do some fishing methods, notably muro-ami. Recreational visits may also cause damage, e.g. anchoring. Reefs are also subject to a variety of natural disasters, including hurricanes, reef-destroying animals (crown-of-thorns starfish) and diseases.

While allocation principles in fisheries tended to become complex over time, and needed to deal with multiple industry sub-groups, the emergence of tourism around the marine and coastal resources has created both opportunities and new challenges for allocating the resources. With few exceptions, exploitation of sea and fisheries resources for tourism have been fraught with conflicts with more traditional fishing activities since fishers rarely reap the benefit from this alternative form of resource use, which directly restrict their livelihoods dependent on the same resources. Hence, increasing tourism and fishing has added to the already complex allocation problems in marine fisheries. Coordination of traditional fisheries, marine reserves, and various

forms of tourism appears to be the best way to avoid conflicts among different users of coastal areas. Short- and long-term resource allocation strategies have to be established in accordance with countries' economic and social needs.

In certain parts of the tropical world, such as the Caribbean, tourism has given to multiplicity of conflicts requiring newer principles of allocation. Even in some Central American countries, the Pacific and Indian Ocean fisheries management of tourism as an integral part of the allocation decision and resource management policies. However, many of the allocation principles have evolved through a trial and error process, and relied heavily on the participation and grass-roots democracies.

4.1 Fishing and tourism interactions in the Caribbean

4.1.1. Soufriere, St Lucia

In this case, a conflicting situation prevailed for over a decade before some principles and policies emerged. The range of conflicts include: (a) commercial dive operators vs. fishermen over the use of, and the perception of impact on, the coral reefs; (b) yachts vs. fishermen because of anchoring in fishing areas; (c) local community vs. hoteliers over the access to beaches; (d) fishermen vs. authorities at both the local and national levels over the location of a jetty in a fishing priority area; and (e) fishermen vs. hoteliers over the use of the beaches for commercial fishing or recreational, tourism oriented activities.

A conflict resolution process was initiated in 1992 by the Soufriere Regional Development Foundation, a community based non-governmental organization (NGO) involved in facilitating development activities in Soufriere. After two years of numerous negotiations between all the parties involved, an agreement on the Soufriere Marine Management Area (SMMA), to be managed by the Soufriere Foundation, was endorsed on February 1994 by the government. The agreement contained details of a proposed zoning agreement (marine reserves, fishing priority areas, multiple use areas, recreational areas, and yacht mooring sites), legal provisions needed to manage individual activities such as fishing, diving, yachting, marine transportation, demarcation requirements, materials for user information, and training needs.

A management plan was produced, defining the institutional arrangements and responsibilities, revenue sources (including specific fees to be charged for various categories of users, systems of fee payment and collection), job responsibilities and skills required for four area wardens and the SMMA manager, specifics of infrastructure needed (demarcation and mooring buoys, demarcation signs), systems for monitoring the resource base and levels of resource use, surveillance, maintenance, and public awareness needs.

In 1997 and 1998, after a period of relative instability, an institutional review with analysis of issues and problems was conducted with all the stakeholders. The SMMA mission states that: "The mission of the SMMA is to contribute to national and local development, particularly in the fisheries and tourism sectors through management of the Soufriere coastal zone based on the principles of sustainable use, cooperation among resource users, institutional collaboration, active and enlightened participation, and equitable sharing of benefits and responsibilities among stakeholders" (ICRI n.d.). As a result, new arrangements were put in place, such as the designation of the zone as a Local Fisheries Management Area, the creation of a new organization, the Soufriere Marine Management Association, comprising all the agencies with management functions in the Area, the establishment of a Stakeholders Committee, arrangements for a structure for law enforcement, development of a communication plan to address specific communication deficiencies.

The project has successfully addressed the main conflicts between users, mainly through zoning. Key to the SMMA's success in managing conflicts on an ongoing basis was the very close contact which exists among user groups, and between them and the

SMMA management. The SMMA played the role of a facilitating link between the user groups and not an enforcement agency.

The SMMA has shown that two essential conditions for conflict management are:

a. Direct participation of resource users, because community institutions do not always provide adequate representation and because stakes/interests often vary from individual to individual; and

a. Direct communication among stakeholder groups, for example, by allowing fishers to directly address conflicting interests to others, such as divers, or yachts people.

4.1.2 Barbados and Negril, Jamaica

The major areas of conflict between fishers and tourism interests in coastal areas are the same throughout the region and include:

a. Beach access: The uses of the two sectors are generally seen as incompatible, and the tourism sector often finds ways to move fishers from beaches used for boat landing or seine fishing;

a. Trap fishing: Recreational divers dislike seeing trapped fish and many are concerned that traps contribute to fish stock declines by catching underage fish; fishers complain that divers cut lines or damage traps to release fish;

b. Zoning: Both sectors fight for Marine Protected Area (MPA) zoning that supports their use and constrains that of the other sector, and both often feel that the other sector is getting the better deal; and

c. Decreases in fish stocks: Fishers believe that pollution and sedimentation from tourism construction, beach resorts, and other tourism facilities are responsible for fish stock declines, while tourism interests are more likely to attribute declines to over-fishing.

Conflict resolution in Barbados consisted of an agreement between the tourism and fisheries sectors and the government on a legal fish trap mesh size adequate to protect young stocks. Since some dive tourists were damaging traps, the national fisheries association got support from the tourism sector and government for a visitor information program on how the mesh size law protects young fish.

In the case of Negril, Jamaica, until its transformation into a major tourism resort, the economy of Negril, revolved largely around fishing. While some residents have now found opportunities in tourism, many still rely on fishing for much or all of their income. The Negril Marine Park has worked hard to protect and enhance local livelihoods. The NGO that manages the Park relies on the help of community partners, including the fishing and tourism sectors. Representatives of both sectors are on the NGO's Board and so have regular input into management.

Many Negril fishers have supported the Park and become involved in management measures, such as protected nursery areas. These committed stakeholders have also been successful in getting other fishers to use good management practices, but they cannot deal with issues that involve other types of users (for example tourist boats that anchor in nursery areas) or "outside" fishers who do not respect local rules. For these matters fishers need help from government enforcement agencies, but they do not feel that these agencies take their problems seriously.

Coastal development has had serious impacts on the Park's natural resources, but planning decisions are generally based on narrow economic analyses and rarely take the existence of the Park or the needs of local fishers into account. For example, a hotel developer was permitted to dredge through a sea grass bed within a protected nursery area. The Park has no recourse when planning decisions are taken at the political level. Over the years tourism expansion has squeezed fishers out of traditional landing beaches and forced them to move to less suitable areas. Although beaches are supposed to be public, allocation of their use is based on the property rights of adjacent

landowners, not the traditional rights of local users. These are some of the challenges that the Park and the fishers are facing together (CANARI 2005).

4.2 Fishing and tourism interactions in Central America: Galapagos, Ecuador

The islands' fisheries and tourism resources are both under pressure from the domestic and international markets. The relative success of these industries in the Galapagos, combined with a high rate of unemployment and underemployment in mainland Ecuador, has turned the islands into a magnet for migration.

The establishment of the Galapagos National Park, especially the delimitation of its boundaries, provoked the first major conflict with the local populace. Declaration of the marine reserve in 1986 and approval of the management plan in 1992 (PDR–CPIG, 1992) produced a second conflict, essentially over the move from a system of free access to one of restricted access, without any effort to provide information, use persuasion, or negotiate with key users of the marine resources.

The zoning of the marine reserve by executive decree, without the support of law, highlighted at least five areas of conflict among the various interest groups (Coello, 1996):

- Conservation interests vs. small-scale and commercial fishers;
- Local fishers vs. mainland fishers;
- Small-scale fishers vs. tourism;
- Commercial fishing vs. small-scale fishers, the authorities, and tourism; and
- Conservation authorities vs. fishing authorities versus military and police authorities.

After 1990, progressively more severe restrictions were placed on free access to certain fishing resources, but no thought was given to providing compensation or finding alternative solutions. By mid-1994, fishing interests were complaining that they had been without work for 14 months, thanks to the various prohibitions or closed seasons that blocked them from their primary fishing sources and the fact that a freeze had been placed on permits for expanding the size and capacity of their fleets.

The sea cucumber fishery, in which high profit margins led to flagrant violations of national park rules, was the flashpoint for disputes between local fishers, especially those of Isabel Island, and the authorities for the protected area. This activity, which had arisen as a substitute for lobster trapping during the closed season, was legally open for only a few months in 1992 and between October and December of 1994.

The closing of this fishery provoked a series of violent reactions, and illegal fishing became the number-one problem in the region. In 1995, a popular uprising saw the active involvement of fishers, who went as far as to threaten to kidnap tourists and to burn areas of the national park. The national park authorities confiscated large volumes of sea cucumbers, and the fishers suffered losses amounting to thousands of dollars.

With respect to fishers, there was a general feeling of exclusion brought about by the systematic increase in restrictions on access to fishing resources without any process of consultation or direct or indirect measures of compensation. The underlying causes also included tensions arising from:

The perception of a tacit alliance between the conservationist forces and mainland tourism companies to displace fishers from coastal areas (the intertidal and lagoon zones) that had been their traditional fishing grounds but were now coveted by tourist interests as areas of great biological diversity and as favoured waters for recreational diving.

The growing crisis among local tourism operators, who had invested heavily in infrastructure that was now under-occupied; the lack of local government funds to meet the needs of rapidly growing human settlements; the inequitable distribution among the islands of the benefits of tourism, which had been concentrated primarily on one island; and the influx of new fishers from the mainland, the increase in illegal fishing in the marine reserve, and the fines and penalties exacted against violators.

In order to forge a resolution to the conflicts, the following three key points were made:

1. preparing a frame of reference for addressing the problem and defining strategies;
2. establishing a participatory process to revise the management plan of the marine reserve; and
3. preparing the special legislation, the Regime for the Province of Galapagos (Congreso Nacional, 1998).

The approval of this legislation clarified the legal regime governing the entire island territory. This put an end to jurisdictional disputes between the provincial and the conservation authorities, set limits on the scope of each entity's authority and action, and clearly establish the manner in which available economic resources are to be distributed. More significantly, it set a precedent for the sustainable management of natural resources by local communities by defining the principles that are to govern policies and activities in the national park, the marine reserve, and the various human settlements. These principles represent an unprecedented advance; they incorporate the concepts of conservation and sustainable development into Ecuadorian legislation, in line with the international instruments adopted during the Rio Summit and in keeping with regional decentralization schemes, respect for traditional user rights, and the recognition of local management capabilities.

The new law had important implications for the local fishers:

- It introduced the principles of conservation, adaptive management, and sustainable use, as well as a zoning structure for fishing activities;
- It created the category of marine reserve, with multiple uses and integrated administration, for protecting marine resources;
- It confined the extraction of marine resources to the local, small-scale fishery;
- It empowered the national park authorities to collect, administer, and distribute tax revenues to finance the marine reserve's management plan; and
- It created a participatory management body.

The case of Galapagos Islands, Ecuador, exemplifies an evolving allocation and management in protecting a valuable natural area, a prolonged conflict over the use of marine resources by various sectors, and recent efforts to manage the conflict through a participatory process (Oviedo, 1999).

4.3 Fishing and tourism interactions in the Indian Ocean: the Maldives

Establishment of marine protected areas in the tourism zone to protect marine biodiversity by supporting in-situ conservation and the aesthetic integrity of marine dive sites is a specific ecotourism project among a few which aims to solve problems that arise due to conflict of interests between divers and fishers using the same marine resources. Twenty-five important dive sites have been declared as marine protected areas in the main tourism zone where anchoring and fishing (except bait fishery that sustains the traditional pole and line fishing industry), is strictly prohibited (Maldives Ministry of Tourism, 2005).

5. CONCLUSION

While fisheries management objective has shifted toward preserving the integrity of the ecosystem and biological diversities, a major element of fisheries management in the developing country is ensuring equity benefits and managing multistakeholder conflicts. The complexity of fisheries allocation issues calls for an integrated approach to dispute management. CBD and MPA management while restricts allocations (including imposition of no take zone), market based allocation such as quota and TURF-type of allocation can still promote the principle of economic efficiency (Gordon, 1954; Scott, 1955). Both vertical (in relatively specialized fishing) and horizontal (in cases where multiple uses are concerned) integration will have to be utilized in order to

maximize the benefits from the ocean and to assure that allocation issues are managed in a socially, economically and environmentally sustainable manner. Non-extractive use, such as diving and tourism (chartered boat; sea taxi) can be the basis of horizontal integration of resource allocation, and give equity benefits to fishing communities. This way, management can address the issue of losses to fishermen from reduced fishing ground due to MPA management. The WSSD goals require drastic actions of overcapacity in industrial fisheries—allocation of equitable use rights, effort reduction along with strengthening monitoring and control system through co-management type of arrangements (World Bank 2004). Likewise, in small-scale fisheries, MDGs and WSSD will warrant support for organization of fishers, allocation of use rights, alternative employment and income generating opportunities, and establishment of MPAs, where needed (World Bank 2004).

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THEME 3
Allocations within sectors

Assigning property rights in the common pool. Implications of the prevalence of first-possession rules

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ABSTRACT

Rights-based institutions have been adopted for certain natural resources in order to more effectively mitigate the losses of the common pool. Past central government regulation has not proved satisfactory. A major issue has been the assignment of those rights. In this paper, I examine three different allocation rules: first-possession, lottery or uniform allocation, and auction and draw predictions as to when they might be adopted. I analyze the assignment, timing, and nature of the rights granted in five resources: oil and gas unit shares, water rights, radio spectrum rights, emission permits, and selected fishery ITQs in six countries (Australia, Canada, Chile, Iceland, New Zealand and the United States). I find that rights-based arrangements generally are adopted late, but when they are implemented, first-possession rules dominate where there are incumbent users. Lotteries and auctions are rarely used. I discuss criticisms of first-possession rules and argue that first-possession is likely more efficient than previously recognized. Accordingly, restrictions on such allocations (rights set-asides for particular groups and exchange limitations) may be costly in the long run for maximizing the value of the resource. I also look at government regulation of use rights to water and the radio spectrum under the public interest and public trust doctrines. The record suggests that private, rather than public interest considerations dominate agency decisions. There may be similar regulatory effects in fisheries and other resources.

1. INTRODUCTION

There is an accelerated trend toward assigning property rights of some type to resources in order to mitigate the losses of the common pool.[146] A recent survey found that tradable use permits were used in 9 applications in air pollution control, 75 in fisheries, 3 in water, and 5 in land use control.[147] These institutional innovations have taken place as the resources have become more valuable, as they have faced growing open-access or common-pool losses, and as dissatisfaction has increased with existing centralized

[146] See Stavins (2003) for discussion of the movement toward market-based instruments.
[147] Tietenberg (2003, p1).

regulation.[148] There are multiple advantages of property rights arrangements including flexibility, cost-savings, information generation, migration to high-valued uses, and better alignment of incentives for conservation or investment in the resource. The more complete are property rights, the more the private and social net benefits of resource use are meshed, eliminating externalities and the losses of the common pool.[149]

By contrast, centralized (command and control) regulation, which typically relies upon uniform standards, arbitrary controls on access, constraints on timing of use, and/or limits on technology or production capital, suffers from a variety of well-known problems including high cost, inflexibility, ineffectiveness, and industry capture. Further, regulatory decisions take place in the absence of information about alternative uses that market trades generate. Finally, centralized state regulatory rules may or may not align with the incentives of actual users of the resource. Generally, no party involved – actual users, regulators, politicians – is a residual claimant to the social gains from investment or trade.[150] Accordingly, extraction, production, investment, and allocation decisions are based on other factors that are apt not to be consistent with maximizing the economic value of the resource or of conserving it. Indeed, the experience with many central regulatory regimes has not been satisfactory—fisheries continue to be depleted; air pollution abatement targets have not been achieved; water has not been re-allocated effectively; and technological change in the radio spectrum has been retarded.

Despite the attractions of more definite property rights, they remain controversial, limiting or slowing their adoption. They generally are adopted only late, after conditions have deteriorated for many regulated resources.[151] Allocation is the most controversial aspect because of the distributional implications involved in moving from open-access or central regulation to a property regime.[152] In many cases, at least some constituencies, including regulators, who benefited from the previous regulatory arrangement, will be disadvantaged under a new rights system. Hence, these parties will resist the new arrangement until there are few options.

More broadly, any property right that has meaning involves exclusion, so that some parties that previously used the resource will be denied access. Production under a property rights regime has a different composition of inputs and timing than what occurs under open-access or regulation, with negative impacts on certain groups of labor, input sellers, service organizations, and processors. These production changes are inherent in the efficiency gains of privatization, but not all parties directly benefit from them. Further, as the resource rebounds and becomes more valuable, new owners have wealth, status, and political influence not available to those without access privileges. These distributional factors, along with the costs of bounding, measurement, and enforcement constrain the extent and timing of the assignment of property rights to address the common pool. In this paper, I examine these issues across a variety of resources and develop generalizations for application of ITQs in fisheries.

2. OPEN-ACCESS AND THE ALLOCATION

2.1 The losses of the commons

Garrett Hardin's the Tragedy of the Commons (Science, 1968) made clear in the popular scientific press what resource users had always understood, that open-access can result in important economic and social losses.[153] Hardin was not the first to call attention to the tragedy of the commons. More than a decade before his article, H. Scott Gordon

[148] Stavins (1998b).
[149] Libecap (1989), Dahlman (1972).
[150] Johnson and Libecap (1994, 156-71).
[151] Tietenberg (2003, 10), also notes this empirical regularity.
[152] Definition and enforcement costs for mobile, unobserved resources are also issues as discussed below.
[153] Discussion drawn from Libecap (1998).

(1954) clearly outlined similar logic in another classic: "The Economic Theory of a Common-Property Resource: The Fishery. Gordon=s analysis was extended by Scott (1955), Cheung (1970), among others.

Under open-access, individuals are attracted to valuable resources so long as their private marginal costs of access and production are less than or equal to the average returns for all parties from resource use. Waste occurs for a variety of reasons. One is that short-term production levels are too high and investment is too low. Because property rights are not clearly assigned, individuals in their production decisions do not consider the full social costs of their activities. Accordingly, the net private and social returns from individual production decisions diverge. Production by one party lowers the productivity of others. These technological externalities are seen by all parties, leading them to rush production before their competitors. As a result, total output or harvest by all parties exceeds the social wealth-maximization point, where social marginal costs equal social marginal returns. Therefore, individuals exploit the resource too rapidly and intensively at any time, relative to interest rate and price projections. Further, the emphasis on competitive, short-term production ignores long-term investments. The incentive to invest is reduced because investors cannot anticipate that they will capture the resulting returns.[154]

Another source of waste is limits on exchange due to the absence of more definite property rights. Demsetz (1967) argued that an assignment of property rights was a prerequisite for markets to facilitate socially-valuable trade among economic agents and thereby, to create asset prices that reflected underlying demand and supply. In the absence of market price signals, open-access resources do not flow smoothly or routinely to higher-valued uses as economic conditions change. Moreover, they are not allocated effectively over time. When market prices indicate that the present value of resource rents is greater from future, rather than current use, exploitation will be delayed. Under open-access, however, there is little incentive for economic agents to postpone resource use to the future.

Finally waste occurs because under open-access competing claimants must divert labor and capital inputs from socially-valued production to predatory and defensive activities.[155] Rent-dissipating violence among competing claimants is possible.

2.2 Central state (command and control) regulation

In cases where the resource is relatively easily bounded and measured, such as land, and where the numbers of parties involved are small, some type of locally-devised property institution effectively mitigates the losses of the commons.[156] Group or common property arrangements are an example. Where these conditions are not met, the initial response to open-access generally has been state regulation of entry and production to include: (a) restrictions on access or time of use, such as limits placed on non-citizens or non-residents in fisheries or prohibitions on use of large parts of the radio spectrum; (b) equipment controls, such as on vessel size or technology used in fisheries and uniform requirements for scrubbers on power plants; and (c) extraction regulations, such as prorationing in oil production and air pollution emission controls. The aim of these regulations is to constrain output to more optimal levels and thereby avoid some rent dissipation.

State regulation is the initial resort for a number of reasons. One is that it avoids the complex, costly, and controversial allocation of more definite property rights, which could directly address the problem of externalities. Second, state regulation may involve

[154] Indeed, empirical studies of land use in developing areas document the importance of property rights for mitigating common-pool conditions and encouraging investment (Alston, Libecap and Schneider 1996).

[155] Umbeck (1981).

[156] Issues of measurement are addressed in Barzel (1997).

lower costs of measurement, bounding, and enforcement, and if the resource is of relatively low value, more definite property rights may be too costly to be an option.[157] Another reason is that state regulation is consistent with the notion that many natural resources are rightly "public" with ownership reserved in the state rather than in private parties. Similarly, if there are important public goods associated with the resource, then state ownership and regulation of access may be optimal. There are, however, potential problems associated with use and regulation under vague and uncertain concepts of the "public interest" or the "public trust" as described below. Finally, state regulation can advantage certain influential political constituencies who mould regulatory policy in their behalf. While market processes are relatively transparent, political and bureaucratic processes are less so, facilitating preferential treatment to certain parties.[158] This situation underlies the notion of regulatory capture.[159]

One of the constituencies in regulation is the bureaucracy itself which develops a stake in the maintenance and expansion of state authority and resistance to property regimes where more decision-making responsibility is granted to actual resource users. Agencies often are relatively insulated especially when resource management requires scientific knowledge that may not be generally available to citizens. Hence, agency officials can manage the resource to maximize budgets and regulatory discretion, to advantage particular favoured constituencies, and/or to advance particular political, scientific, and professional views of resource access and use. Since neither politicians nor bureaucrats are direct residual claimants to the resource rents that are saved by mitigating the losses of open-access, their regulatory decisions may or may not increase the social or economic value of the resource.

For all of these reasons, when the costs of central regulation become large and its effectiveness in stemming open-access losses questioned, other options become considered. If the resource is of high enough value to warrant more definite property rights, then they can be adopted. But property rights arrangements are costly and how they are implemented affects their efficacy in addressing the losses of the commons. A key issue is that of allocation.

2.3 Allocation of property rights

Demsetz (1967) suggested a smooth process of the emergence of property rights as resource values rose, offsetting the costs of definition and enforcement. But experience reveals that the process of institutional change is more complex than he envisioned.[160] Allocation is contentious because of the assignment of wealth and political influence associated with exclusive property rights. Property rights are political institutions and the underlying negotiations determines the nature of the rights arrangements that ultimately emerge, their timing, and effectiveness.[161] As emphasized by Coase (1960), allocation rules are always important for distribution and they affect efficiency in the presence of transaction costs. Property rights allocation also is affected by other factors, including the physical nature of the resource, the number and heterogeneity of the parties involved, equity norms and precedents, and the legal environment. There are several allocation mechanisms:

[157] See Alston, Libecap and Schneider (1996) for discussion of the emergence of property rights as resource values change.

[158] For discussion of the problem of oversight when information is limited, see Johnson and Libecap (2001).

[159] Posner (2003; 346-349, 370-374, 529-537). "Over time, regulatory agencies come to be dominated by the industries regulated."

[160] Rose (1998).

[161] See Libecap (1989).

2.3.1 First-possession rules

First-possession is the dominant method of establishing property rights.[162] It assigns ownership on a first-come, first-served basis or first-in-time, first-in-right. First-possession rules are attractive because they recognize incumbent parties, who have experience in exploiting the resource and hence, may be the low-cost, high-valued users. Incumbents also have a direct stake in access to the resource and will be important constituents in any property rights distribution. They are concerned about past investment in specific assets, which otherwise would not be deployable to other uses. Since first-possession rules recognize these investments, this security should encourage future outlays. Allocations that do not consider the position of incumbents will face opposition, raising the costs of rights assignment and enforcement.[163] Accordingly, grandfathering in initial allocation has been a necessary ingredient in building the political support necessary to implement the approach.[164]

There are other reasons why first-possession rules can be efficient. In principal, they recognize first-movers, innovators, entrepreneurs, who first experiment with and use a resource. Society benefits from innovative, risk-taking activities, and first-possession recognizes such actions. Further, under first-possession the market determines optimal claim size, whereas under other allocation arrangements bureaucratic or political objectives define the assignments. If these are not consistent with optimal production size then further trade is required, and if transaction costs are high, such exchange might be limited. Hence, first-possession can economize on transaction costs.[165]

Examples of first-possession rules include allocating property rights based on historical catch in fisheries, on past fuel use in emission permits, prior appropriation in water rights, past utilization in spectrum allocation, and on novelty in patent and copyright assignment. First-possession rules also often include beneficial use requirements for maintenance of the right to limit hoarding and constraints on valuable new entry.

The rule-of-capture that applies in fishing, oil and groundwater extraction is a type of first-possession rule. Ownership is granted to the party that invests in extraction. But the rule-of capture grants ownership to the flow and not generally to the resource stock, and hence in the presence of open-access conditions, it can exacerbate competitive extraction incentives. If the competing parties are homogeneous and ownership is short-term, then full dissipation is possible as parties rush to "capture" the asset. If, on the other hand, the parties are heterogeneous and use rights are long-term, then first-possession assignments to a flow can mitigate rent dissipation.[166]

The same criticism of first-possession rules and rent dissipation applies if homogeneous claimants race to establish property rights to the stock.[167] But as before, if the parties are heterogeneous and the resulting rights are secure and permanent, then full dissipation will not occur. There are costs with any rights allocation rule, and the "winners" of such a race may be the most efficient producers. Accordingly, first-possession may not be more costly than other assignments. Generally, if the transaction costs of subsequent exchange are high, then it makes sense to assign rights to low-cost users with histories of past involvement in the resource.

Despite their ubiquity, first-possession rules often run afoul of fairness considerations, and this situation raises political opposition to them. First-possession discriminates

[162] See discussion of first possession in Epstein (1979), Rose (1985) and Lueck (1995, 1998).

[163] On the American frontier, "squatters" moved ahead of the federal land survey. When the land was subsequently surveyed and opened for claiming, "claims clubs" formed to prevent outsiders from encroaching on pre-existing holdings. See Gates (1968, p152).

[164] See also, Tietenberg (2003, p10).

[165] See Epstein (1979).

[166] Johnson and Libecap (1982) show that heterogeneity among fishers limits rent dissipation even under open-access and the rule of capture.

[167] Stavins (1995) refers to grandfathering as a give away. Inefficiencies would come through a race of homogeneous parties.

against new entrants. There are wide-standing views that "people should get what they deserve and deserve what they get." If first-possession ownership is viewed as rewarding those who by luck and connections were allocated the right, then they may be opposed or their returns taxed.[168] In the case of intellectual property rights, where the fixed costs of research and development are low, as may be the situation in software, it is argued by proponents of the "open source" movement that copy rights and patents are inefficient. They deny access, expansion of the market, and related subsequent innovation.[169]

2.3.2 Uniform allocation rules.

Equal sharing rules avoid the distributional concerns associated with first-possession and better reflect egalitarian goals. If there are no restrictions on subsequent exchange of property rights and transaction costs are low, there are few efficiency implications. The resource still migrates to high-valued users. Uniform allocations also avoid the measurement costs of verifying claims of past production or use or of documenting precedence claims that are part of first-possession assignments. They can also avoid the costly pursuit of property rights when first-possession is known to be the allocation rule.

Lotteries are examples of uniform allocations because each claimant is given an equal, random draw in the assignment of rights to the resource, and the allocation granted generally is partitioned equally among lottery winners. Uniform allocations via lotteries are most effective when applied to new resources where there no incumbent claims and all parties are relatively homogeneous. They can also be used when the access and use rights granted are short-term and no long-term ownership is implied, such as with lotteries for annual hunting licenses. Where there are existing parties who use a resource informally (and sometimes illegally), implementing a uniform allocation rule for the assignment of formal property rights is resisted because it does not recognize prevailing claims. Opposition by established users to the reallocation of rights as part of a uniform allocation rule will raise the costs of definition and enforcement.[170]

2.3.3 Auction allocation

A third allocation mechanism is auction. It can directly place asset into the hands of those who have the highest value for the asset. It thereby avoids the transaction costs of reallocation. Auctions also generate resources for the state and avoid the windfalls that might be considered unearned and divisive. Auction returns can be used to cover the costs of defining and enforcing property rights and other costs of resource management. As with lotteries, auctions work best for new, unallocated resources where there are no incumbent claimants and where resource values are very high. By granting more of the rents to the state, auctions reduce the distributional implications of first-possession or uniform-allocation.

Incumbents naturally resist auctions in the allocation of rights because they are forced to pay for something they believe they are already entitled to because of first-possession. For these reasons auctions not used as often as economists have predicted.[171] Auctions can be used in conjunction with other allocation arrangements to provide an adjustment margin when some parties are not allocated sufficient property rights for efficient production and the transaction costs of gaining additional increments from others are high.

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[168] Alesina and Angeletos (2005, pp960-980).

[169] Lerner and Tirole (2005).

[170] On the United States agricultural frontier, the existence of incumbent informal land claimants or squatters led to enactment of the Preemption Acts that gave them preference in the allocation of formal property rights. Failure to do so would have led to conflict between existing and new claimants.

[171] Tietenberg (2003, p10) notes that auctions were used extensively in just one ITQ in Chile. Historical catch was the dominant allocation mechanism. Lueck (1998, p136) points to the costs of auctions.

As with other allocation arrangements, there are costs to auctions. The state must be able to measure and enforce resource boundaries and individual allocations secured by auction. The terms of the auction may also be influenced by competing claimants who lobby for rules that provide them with specific advantages.

2.4 Transaction costs

Property allocation systems are affected by transaction costs. These are a function of information about the resource, the nature of the asset, the number and homogeneity of the claimants, equity concerns, and public trust or public interest notions. Throughout the discussion below, the comparison is between open-access and a property regime, but it applies as well with a comparison with central government regulation and property rights.

2.4.1 The nature and distribution of information about the environmental/resource problem to be addressed by a property rights allocation

If there is limited or asymmetric information about the size of open-access or regulatory losses or of the costs of addressing them, the expected gains from a property rights allocation as a solution will be uncertain. This situation raises the transaction costs of assigning rights. Resource users will not be able to effectively compare the advantages of a more formal rights system with returns under open-access and regulation or to determine how they will fare in the new arrangement. There are costs of organizing to influence the rights allocation mechanism, as well as costs of defining and enforcing individual claims. If the benefits are more uncertain than are the costs at any point in time, then a consensus on property rights will be difficult to obtain. Some parties who have adapted well to open-access or regulation may conclude that they are better off under the status quo.

For these reasons, formal property rights often are not implemented until either resource values are very high (the rental losses of open-access or central regulation are very large) or until late in the use of a resource when the open-access losses have largely been borne and the stock is close to depletion. At that time, the benefits of property rights become clearer. Information about open-access or regulatory losses and the costs of addressing them is spread more evenly. Additionally, transaction costs are lowered because with reduced earnings and the depleted state of the resource, there are fewer claimants to involve in the allocation of property rights.

In order to avoid long-term rent dissipation, an appropriate state response is to provide credible, scientific information about open-access losses such as the size of declining fish stocks, air pollution costs, or lost amenity values of a resource and about the sources of those losses. Recognition of existing users in any proposed rights arrangement and enforcement guarantees also can speed institutional change. First-possession allocation rules reduce uncertainty for incumbent users in the calculation of individual net gains from adoption of property rights.

2.4.2 The physical characteristics and value of the resource

Larger, more mobile, unobservable environmental/natural resources such as groundwater, air, and fish and wildlife stocks have higher measurement, and enforcement costs in assigning and protecting property rights than do stationary resources such as land. The state may lower transaction costs by providing information about the boundaries of the resource and by defining and enforcing individual partitions of it. Accurate measurement and effective enforcement are critical for the success of any rights-based regime. Large migratory resources that are difficult to bound may not be successful candidates for individual property rights because partitioning may not be feasible. Larger rights allocations covering extensive territories may be more plausible, but they involve greater enforcement costs.

More valuable resources also are associated with higher enforcement costs because there are more claimants and potential entry. Resource values may rise due to exogenous supply and demand factors or due to the gradual depletion of the resource under open-access. As open-access losses increase for valuable resources, the returns to the assignment of property rights rise. Capturing a portion of rents that are saved is the motivation for individual parties as they negotiate for the assignment of property rights. As outlined by Demsetz (1967) more valuable resources tend to have more precise property rights because the larger benefits from definition and enforcement offset the higher costs of doing so.

2.4.3 The number and heterogeneity of the bargaining parties

An extensive body of research on collective action regarding natural resources as well as within cartels reveals that larger, more heterogeneous groups have higher costs of reaching agreement and enforcing compliance. There is potential for free riding, holdup, and defection. The state can mitigate these problems by defining property rights to limit entry and by punishing those who violate contracts and trespass. In contrast, smaller, more homogeneous groups are better able to find consensus on the allocation of property rights. This suggests that allocation of rights to new resources with no pre-existing claimants can occur at less cost than will be the case for established resources with heterogeneous incumbent claimants and new entrants.[172] Similarly, Ostrom (1990) and others have shown that small homogeneous groups with frequent interaction can effectively reach agreement on resource allocation and use. These groups often use community property rules to mitigate open-access problems and enforce them through norms and customs. These arrangements, however, may not be sustainable in the face of exogenous increases in price and entry by new claimants.

2.4.4 Equity and precedent of resource ownership, access, and use

As noted above, norms of fairness affect the allocation of property rights. An ownership distribution that is highly skewed and is not open to entry by ambitious non-owners can be costly to enforce and hence, be unstable. Resentment of windfall allocations that are based on luck or political connections may lead to reallocation efforts or to tax policies that capture at least a portion of the windfall gains. These actions add uncertainty to any property rights regime and reduces its effectiveness in addressing open-access losses. For example, if ITQs are allocated based on historical catch and the fishery stock rebounds under the new arrangement, quota owners may receive considerable gains in wealth. Those denied access to the fishery under the allocation rules may lobby for a share of those gains via taxes or other quota restrictions. This sets the stage for political conflict over the regulation of the fishery. As Johnson (1995) shows, these taxes are not neutral in terms of impact on the incentives of ITQ holders to conserve the stock.

Some resources, such as water or some wildlife, have been viewed as inherently public and private ownership has been resisted. Two related regulatory concepts are those of the public trust and the public interest.

2.4.5 Public trust/public interest

The "public trust" is a common law principle creating the legal right of the public to utilize certain lands and waters, such as tidewaters or navigable rivers, and other waters and natural resources with high amenity or public goods values.[173] Under the doctrine, the rights of the public are vested in the state as owner of the resource and trustee of its proper use. It historically had fairly narrow application, but broader interpretations

[172] Libecap (1989).
[173] Getches (1997, p217, pp224-228).

are advocated by some parties.[174] For example, recent water diversion restrictions have been implemented in the United States West under the public trust to protect natural habitat.[175]

The justification for public trust is that many vital natural or environmental resources provide important public goods that would not be provided effectively by private ownership because of the inability to exclude and to appropriate the returns from production and investment. Other justifications are based on equity of access; that private ownership would result in excluding most citizens from access to naturally-occurring resources. Therefore they should be held in the public trust and not given away.[176]

The public trust, however, is a vague concept that can be used opportunistically by interest groups to advance their preferred uses of the resource without compensating other parties. Where there are undisputed public goods at stake, then the public trust can be used to protect them via state regulation. Where there are mixed private and public values at stake in resource use, then the benefits are not so clear. While market failure to provide public goods is articulated by proponents of the public trust, the incentives of the state to provide public goods are less clearly outlined. That is, regulation in the guise of pubic trust can be used to advance special interests rather than resource or environmental improvements.

Accordingly despite its attractions, extension of the public trust doctrine as justification for limits on rights-based approaches comes at a cost. The associated regulatory interventions weaken property rights, promote open-access conditions and conflict, and thereby potentially dissipate private and public values of the resource. Valuable trade is reduced; useful information about alternative resource uses is not generated; important private investment is foregone; and competition over the common resource brings waste. Additionally, with so many interests involved, it may be impossible to reach consensus in allocation and use decisions. The high transaction costs of reaching agreement result in paralysis and lock-in of resource use in existing patterns, even though new, more valuable demands for its use may have arisen.

2.4.6 Predictions

Although an analytical framework has not been presented here, the discussion suggests a number of predictions for allocation rules:

1. First-possession will be used when there are incumbent users;
2. Uniform allocation or lotteries will be used for new resources where there are no influential incumbents;
3. Auctions will be adopted for new resources where there no incumbent users and where both potential rents and the transaction costs of subsequent trades are high. They also will be used on the margin to add flexibility to an existing first possession allocation system;
4. Adoption of rights-based institutions will come late in resource use when the costs of both open-access and central regulation are high; and
5. The most complete rights will be assigned to resources that are more valuable, less mobile, and more observable.

With these concepts in mind, we now turn to five environmental and natural

[174] Sax (1994, p14) references use of the public trust doctrine in the Mono Lake case of National Audubon Society v. Superior Court, 33 Cal. 3rd. 419, 1983, whereby Los Angeles was restricted from excessive diversion of water from the surrounding watershed that was causing Mono Lake's level to decline. The city was required to limit diversion of water, even though it held the water rights due to purchase of properties in the 1930s. Hence, the city's water rights were weakened. An alternative approach would have been to purchase water rights from Los Angeles in order to raise the lake's level.

[175] Gould (1995, p95), Simms (1995, p321).

[176] Tietenberg (2003, p15).

resources where allocation of rights has been used to address open-access: oil and natural gas, water, the radio spectrum, air pollution emission permits and fisheries. Implications and conclusions are drawn in the final section of the paper.

3. ALLOCATION OF RIGHTS TO SUBSURFACE OIL AND GAS RESERVOIRS IN NORTH AMERICA

In the United States and Canada rights to access oil, natural gas, and other minerals generally are assigned to surface land owners.[177] Actual ownership of subterranean oil and natural gas comes through the common law rule of capture, which as been noted, is a form of first possession. Under the rule of capture, ownership depends upon extraction. This ownership rule, however, creates conditions for competitive open-access extraction if there are multiple surface owners above the deposit.

Oil and gas are lodged in subsurface reservoirs under great pressure. When any part of the surrounding geologic formation is punctured by a well bore, a low-pressure area is created. Natural gas and oil migrate rapidly toward the opening. The extent of migration depends upon subsurface pressures, oil viscosity, and the porosity of the surrounding rock. Reservoirs are not uniform. These characteristics differ across the field, generating inherent variation in well productivity. This migration potentially allows adjacent landowners to extract their neighbor's oil. Because this potential is recognized and because most oil and gas fields in the United States lay below multiple surface land owners (over 1,000 in the huge East Texas field), the stage is set for wasteful, competitive withdrawal.

Land owners grant extraction rights to firms through oil and gas leases. By this process, multiple firms gain access to the pool, and the lease, rather than the field, becomes the unit of production. Many firms, particularly major producers, obtain multiple leases on a reservoir and have operations on many fields. Each firm has incentive to drill competitively and drain to increase its share of oil field rents, even though these individual actions lead to aggregate common-pool losses. Rents are dissipated as capital costs are driven up with the drilling of excessive numbers of wells (more than geologic conditions require or price and interest rate projections warrant) and with the construction of surface storage, where the oil can be held safe from drainage by other firms. Unfortunately, once in surface storage, oil is vulnerable to fire, evaporation, and spoiling. Rapid extraction also increases production costs as subsurface pressures are vented prematurely, forcing the early adoption of pumps and injection wells. Total oil recovery falls as pressures decline because oil becomes trapped in surrounding formations, retrievable only at very high extraction costs. Finally, rents are dissipated as production patterns diverge from those that would maximize the value of output over time.

The common-pool problem has been recognized since oil was first discovered in the United States in 1859 and it has plagued petroleum production wherever there are numerous firms producing from a single formation. The problem also arises in Canada where surface ownership is fragmented as in the United States and parts of the North Sea, the Caspian region, and the Middle East when hydrocarbon deposits cross-national boundaries and producing firms.[178] There never has been disagreement over either the nature of the open-access problem or the general solutions to it. The conflict has been over allocation of oil net revenues under regulation or the assignment of property rights under unitization of production.

The first response to open-access was state regulation of production, with most regulations adopted between the early 1930s and 1960. Libecap and Smith (2002)

[177] With hard rock minerals, such as gold or silver, this ownership arrangement has been modified to grant ownership to an ore vein, allowing the mining owner to follow the deposit below the surface properties of others. For discussion, see Libecap (1978).

[178] For general discussion of the common-pool problem in oil and gas production, see Libecap (1998).

describe the pattern of state regulation of oil and gas production. Overall production "allowables" were determined each year in each state based on geologic conditions and, more importantly, on estimated oil demand and supply. These allowables were then prorated among the regulated firms as annual production quotas. First-possession was the allocation mechanism and the specific factors included past production and investment, such as the number and depth of existing wells on a lease. The latter variables encouraged denser drilling of deep, costly wells in order to increase prorationing quotas, and thereby shifted production allowables from low- to high-cost producers. Further to gain their political support for regulation, the owners of numerous small, high-cost firms in Texas were able to obtain exemption from prorationing rules for their so-called "stripper" wells (very high-cost, low-production wells). These and other preferences to high-cost small firms reduced the overall benefits of regulation by over $2 billion annually by the early 1960s, but they allowed for some of the margins of competitive output to be controlled.[179]

The most complete solution to open-access in oil and gas production is field-wide unitization. Under unitization, production rights are delegated through negotiation to a single firm, the unit operator, with net revenues apportioned among all parties on the field (including those that would otherwise be producing). As the only producer on the field and a residual profit claimant, the unit operator has incentive to maximize field rents. Accordingly, unitization results in important economic gains: a time stream of output that more closely approximates the rent maximizing pattern, increased oil recovery, and reduced wells and other capital costs.

Despite these attractions for mitigating the substantial losses in involved in common-pool crude oil production, early, complete, voluntary field-wide unitization has not been widespread. Libecap and Wiggins (1985) reported that as late as 1975 only 38 percent of Oklahoma production and 20 percent of Texas production came from field-wide units. For a unit to be complete, it must cover all of the formation and include all leases. Under voluntary unitization then, unanimity is required for agreement on a unit contract, and there is potential for holdouts to block agreement.

The key issue of contention is the allocation of shares of the net proceeds of unit production among the various parties.[180] These shares are property rights to the unit rents. Shares are assigned as first-possession rights based on lease values, but measurement is a major obstacle. Each lease's share is assigned in part on current and cumulative past production, which advantages those leases that were oldest and produced the most over newer leases with more limited production histories. The other allocation factors are estimates of the lease's strategic position on the hydrocarbon formation or future production potential. Strategically-located leases may be on the path of oil migration or have other locational advantages that allow them to do well under open-access production. These leases have the greatest potential to hold out. Measuring past output is not a source of contention; rather allocation conflicts are based on both legitimate disputes over the future production potential of a lease where information is imperfect and over strategic maneuvering.

Wiggins and Libecap (1985) examine the bargaining problem underlying unit formation and Libecap and Smith (1999) describe the nature of a complete unit contract. As a result of conflicts over allocation, unit agreements can take a very long time to negotiate or breakdown and result in incomplete units that cover only part of a field. In their detailed analysis of 7 units in Texas and New Mexico, Wiggins and Libecap found that they required from 4 to 9 years from the time negotiations began until agreements could be reached. Moreover, in 5 of the 7 cases the acreage in the final unit was less than that involved in the early negotiations. With incomplete units, part

[179] Libecap and Smith (2002, S595).
[180] Libecap (1989, 93-114).

of the reservoir remains open-access or is organized into competitive subunits with significant losses.

Owners of small, very productive, strategically-located leases systematically withheld agreement in order to extract larger shares that better reflected what they believed they could get under unregulated production. At the same time firms with large holdings on a given field were most likely to agree early to a unit regardless of allocation because they bore more of the fieldwide losses of competitive extraction. Giving up some share allocation was offset by increases in overall production at lower cost. Negotiators for these firms tended to be more flexible in negotiations over allocation rules.

In all cases, agreement on voluntary unitization did not occur until late in primary production. The incentive to agree to the unit at that time came because secondary oil recovery through artificial injection of water or other substances to expel remaining oil is more effective with unitization. In addition, disputes about production potential became less important as all leases neared primary depletion. Unfortunately, by that time, many of the open-access losses associated with competitive production were already inflicted on the field.

To speed unitization, states have intervened with so-called compulsory or forced unitization statutes. These statutes relax the unanimity voting rule on share allocations. Between the late 1940s and the 1960s, all oil-producing states, except Texas adopted some form of forced unitization law to facilitate unit formation. Only in Texas was the power of small firms sufficiently great to block the legislation. Not surprisingly, Texas has a lower share of production from fully-unitized fields than does other states. It also has had more high-cost producers than other states.

4. THE ALLOCATION OF SURFACE WATER RIGHTS IN THE WESTERN UNITED STATES

In the United States there are two types of water rights, riparian and appropriative. Riparian rights tie ownership of water to the ownership of the land that is appurtenant to water flows. Riparian rights are the common law institutions that dominate in the eastern United States. They are recognized to lesser degree in some western states, such as California and Texas.[181] Each land owner has a claim to use a reasonable portion of the water that flows across or adjacent to his or her property. Riparian rights are a type of common property.

The other surface water ownership arrangement, prior appropriation, is found in the semi-arid West and it is based on first-possession. The appropriative doctrine emerged in the 19th century in response to the development of mining and agriculture in the semi-arid West where growing numbers of people and economic activities were increasingly concentrated in areas where there was too little water.[182]

Under the appropriative doctrine, the first claimant can divert a certain amount of water from its natural course for private beneficial purposes on land remote from the point of diversion.[183] Subsequent claimants can also divert water with lower priority rights. On a stream, then there is a ladder of rights, ranging from the lowest to the highest priority. During times of drought when stream flows are reduced, the highest priority claimant receives water before junior claimants, who share the residual according to their priority. Hence, the more senior the claimant the more definite the amount of water secured by the right.

Importantly, under the appropriative system, individuals generally gain only usufructory or possessory rights to water, subject to the requirement that the use be beneficial and reasonable and to oversight by the state in monitoring transfers to

[181] California, Nebraska, Oklahoma, Oregon, Washington, North and South Dakota, and Texas have some riparian systems. See Getches (1997, p8).

[182] Thompson (1993, p681), Glennon (2002, pp14-21).

[183] Getches (1997, pp74-189).

insure that they are consistent with the public interest.[184] Measurement of beneficial use typically is physical diversion. Accordingly, possessory rights holders have had little incentive to conserve water or to leave it in stream since that could be evidence of a lack of beneficial use.[185]

Because appropriative rights can be separated from the land and sold or leased, they can be the basis for private water transfers in response to changing economic conditions. But trades that change the location of water diversion, nature of use, and timing, especially if they are large relative to stream flow, are restricted by state law and regulated by state agencies. Changes in location of diversion to points upstream, for example, could harm other rights holders by reducing downstream flows. Changes in the location of use, particularly those that are out of basin, reduce return flows and available water to other rights holders. To mitigate these effects, state water agencies typically allow changes in diversion and location for only historical consumptive uses, which is difficult to measure.[186] All water rights exchanges that involve changes in location, timing, or nature of use require state regulatory approval with opportunity for third-party protests of potential harm. To be approved, transfers must demonstrate that they will not harm other diverters on the stream. Some states have more restrictive regulations regarding transfers than do others.

Conflicts over allocation occur when there are proposed trades to re-allocate water from low to high-valued uses. In the American West, approximately 80 percent of consumptive water use is in agriculture, often in low-valued or subsidized crops. New water demands for growing urban areas, such as Los Angeles or Las Vegas, and for environmental and recreational uses to augment instream flows, substantially raise water values at the margin. Whereas farmers may pay $15/acre foot, urban and environmental values may be $300 to $20,000 or more. Griffin and Boadu, (1992, p. 274-5) estimated that the average transfer produced net benefits of $10,000/acre foot. As a result there are significant allocative gains from moving some water from agriculture to urban and environmental uses.

The misallocation of water has been recognized as a problem for a long time, yet water markets have developed slowly and controversially in the United States. The conflict is over the nature of water rights and their exchange. First, there are legitimate concerns about the impact of water trades on other water users (third party effects); there are pure rent-seeking efforts to capture a greater share of the often very large returns possible from reallocation; and there are efforts to block any private water trades and to assert greater state control over water rights under the public trust doctrine. Because individuals typically hold only usufruct rights to the water, there is the potential for retroactive regulatory applications of the public trust doctrine that roll back pre-existing appropriative rights.[187] As discussed above, unless narrowly defined, public trust interventions potentially weaken property rights and their advantages in addressing open-access.

For example, in a far-reaching ruling by the California Supreme Court in 1983 in the Mono Lake case (National Audubon Society v. Superior Court 685 P.2d 709) the court limited Los Angeles' ability to divert water from streams where it had held appropriative rights since the 1930s and 1940s. In general, Los Angeles was not compensated for the lost water and had to secure alternative sources. Public trust extensions emphasize that private water usufruct rights are non-vested and revocable and that such actions are

[184] Gould (1995, p94), Simms (1995, p321) Getches (1997, p83).

[185] There has been movement to recognize instream flows as a beneficial use.

[186] Anderson and Johnson (1986) and Johnson *et al.* (1981) describe how specifying a property right in water in terms of consumptive use with options for third party grievances can be an effective method for promoting transfers.

[187] Getches (1997, p11). Simms (1995, p321).

non-compensable.[188] There apparently is no constitutional basis for takings challenges of public trust restrictions of private water rights.

Because water rights are comparatively weak (relative to land) and subject to considerable regulatory oversight, the transaction costs of exchange can be high - 20 percent or more of the value of the exchange.[189] And large transfers can take years to complete, as is evidenced by the recent purchase of water from the Imperial Irrigation District by San Diego which took some 20 years to negotiate. For all of these reasons Ker, Glennon, and Libecap (2006) show that the gap in water prices from those involving agriculture to urban and environmental exchanges relative to those solely in agriculture have been growing not declining since 1987.[190] This implies that the costs of misallocation are increasing.

Efforts to increase instream flows for valuable fishery habitat, recreation, and amity values illustrate the problems of reallocating water rights. Instream flows require that diversions be restricted, potentially undermining prior appropriation claims based on them. Monitoring costs are high because instream rights are vulnerable to increased diversion by downstream appropriative rights holders.[191] Water supply uncertainty also complicates reallocation. Periodic drought requires a rationing mechanism for allocating the reduced supply among traditional diversions and stream flows. If a minimum flow level is necessary to provide public goods amenities, then traditional irrigation diversions must be reduced. If the mechanism employed is clear, predictable, and involves reasonable compensation, then instream flow rights and appropriative rights can coexist. If the mechanism is more arbitrary, uncertain, and does not include fair compensation, then appropriative water rights are weakened. And the more they are weakened, the greater the losses of open-access conditions for water - more costly conflict, reduced investment and trade, and less information about alternative water uses.[192]

5. ALLOCATION OF RIGHTS TO THE RADIO SPECTRUM

The radio spectrum is a range of frequencies over which electromagnetic signals can be transmitted. It is not a scarce resource in the same sense as oil or water. The extent of electromagnetic range is limited only by technology, and new technologies have increased the density of information that can be transmitted on a wave, therefore reducing minimum channel sizes. New technology has also expanded the portion of the spectrum that is commercially usable. Future breakthroughs promise to fundamentally alter the way the spectrum is used. This could be done by spreading a signal over a larger range, but with very low power, jumping from frequency to frequencies, or by patching together multiple small pieces of frequency. Uses of the spectrum include radio, television, wireless internet, remote controls, cordless (home/office) and mobile (cell/pcs) telephony.

The usual measurement of the spectrum is in Hertz, a unit of frequency. A 1 Hertz wave repeats every second. Therefore, more Hertz means a longer wave. The longer a wave is, the longer an antenna needs to be to capture all the information on the wave. The more information a wave needs to carry, the more it must modulate its frequency. That means it uses a broader range of frequencies (which cannot be used by other transmitters). A TV "channel" is about 6 MHz wide. An FM "channel" is about 2 MHz wide. Thus, TV signals require 30 times the capacity as FM radio signals.

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[188] Blumm and Schwartz (1995, pp709-11).

[189] Thompson (1993, pp704-5).

[190] Ker, Glennon, and Libecap (2006) and Libecap (2006, Chapter 1).

[191] Anderson and Johnson (1986) discuss the problems of defining rights to instream flows under the current appropriative water rights doctrine when diversions or instream flow rights are large relative to stream size.

[192] See summary of open access losses in Libecap (1998, p318).

There are formidable technical problems in allocating property rights to the electromagnetic spectrum. A signal occupies a place in a multidimensional space—time, geophysical space, frequency, power. Signals are encoded in amplitude and modulation of waves of electromagnetic radiation. There is a problem of interference. When signals collide, some of the information they carry is lost. Signals cannot be fenced if they are in the same location, similar power, time, and same or adjacent spectrum frequencies.

In the United States, the spectrum was first used commercially by radio in the 1920s and entry was open with frequencies claimed under first-possession. Broadcast rights were assigned incrementally. The Department of Commerce awarded short-term licenses to the frequencies under the Radio Act of 1912 to minimize interference. The license dictated where a station could broadcast, on what frequency bandwidth and when. Initially license holders could determine how powerful their signals could be. There was little chaos or frequency interference early on. Spurred by the burgeoning popularity of this new medium, the number of frequencies available to broadcast rose from 2 in 1920, to 70 in 1923, to 89 in 1924.[193] By 1922 there were over 500 radio stations. Frequency interference charges were handled in courts, and the licenses were exclusive, transferable, and recognized as a property right.[194] As entry increased and inference rose, there were symptoms of open-access problem and demands for more specific property rights.

These demands could have been addressed by greater enforcement of first-possession claims via the courts. But in 1926, Congress made the spectrum the inalienable possession of the people of the United States and established the Federal Radio Commission to assign wavelengths, determine power, location of transmitters, to regulate equipment used, and to prevent interference. These are powers now held by the Federal Communications Commission, FCC, established in 1934. The previous process of allocating spectrum rights based on first-possession was replaced with a system of administrative licensing of use privileges or operating permits, not property rights, under the Radio Act of 1927, and this practice remains today. Indeed in applying for a license, the applicant must acknowledge that the license does not imply a property right to the spectrum, although the licenses themselves (as use rights) are considered property. There was considerable emphasis on the public nature of the spectrum. Hence, broadcasters acquire no vested interest in the air waves and are issued licenses of no more than three years' duration.

The FCC was granted considerable regulatory discretion that added uncertainty to broadcast licenses. Existing broadcast licenses were grandfathered in their frequencies at no cost to holders as first-possession claims, but new licenses were restricted to be assigned by administrative allocation after review of the ability of broadcasters to serve the public interest. New entry was limited, and values of grandfathered licenses rose. Although incumbent licenses generally were routinely renewed, in re-application holders had to verify to the FCC that their programming was in the public interest, detailing the percentage of time devoted to different types of programs such as entertainment, religion, news, education, discussion, and community. Where two or more parties applied for the same frequency, the FCC assigned the license to the party whose use was considered most suitable.[195]

In 1927, because most of the spectrum remained undiscovered, unused, and unclaimed, the government might have used auctions to allocate licenses to new frequencies, even if the government retained actual ownership to the spectrum. This did not happen in part because the value of the spectrum was still generally unknown, although auctions would have elicited information that was not generated under

[193] Hazlett (2001, p353).
[194] De Vany (1998), Farber and Faulhaber (2002, p3).
[195] White (2000, p9).

other allocation mechanisms. The FCC might also have continued with recognizing new possessory claims, but it did not, largely due to lobby pressure by incumbents. The National Association of Broadcasters as an industry trade group helped to draft the license allocation procedures and they served to limit new entry to protect incumbents.[196] Under the Radio Act of 1927 licensing system, the major broadcasting networks emerged, NBC, ABC, CBS, and remained dominant. In exchange for these limits on entry, the industry agreed to content control by the FCC.

The broadcast licenses administratively assigned by the FCC allocate blocks or slices of contiguous bandwidth frequency, power, time of use, equipment, and nature of use. These license stipulations address interference by controlling inputs. The licenses are not transferable or sub-dividable, and the frequency bandwidth included in the license cannot be used for different purposes. Although license holders are generally prohibited from selling their licenses, the companies that hold the licenses can themselves be bought and sold. License acquisition through mergers is commonplace. In fact, over 70 percent of the current owners of television stations are not the entities that originally received the licenses from the FCC. The sale prices of such companies have largely reflected the scarcity value of their licenses. This transfer, however, is not costless. The FCC uses its authority to extract "voluntary" concessions from license holders that wish to assign or transfer licenses in a merger context."[197]

The same block allocations and dedicated purposes are assigned across the country, but use values vary greatly. Much of the spectrum is not used as a result. New uses require new licenses. As such, the rigid administrative allocation mechanism has hindered the development of new technologies and uses of the spectrum.

Administrative allocation of licenses remained the dominant assignment mechanism until 1981 and still today accounts for 98 percent of the spectrum that is available commercially.[198] The alternative is to define specific exclusive rights to the spectrum in time, area, field strength, and bandwidth. For example, bandwidth confined within fiber optic cables, which is technically identical to wireless, is privately owned and traded.

In the late 1970s technology made possible cellular telephone uses and demand grew for access to more spectrum. The administrative process was slow and there was little public interest content in cellular phone use. In 1981 the FCC was authorized by Congress to use lotteries for non-broadcast spectrum uses. Over 1,400 transferable cellular telephone licenses were granted through 1989. The FCC restricted the lotteries to applicants who could certify themselves as "capable of constructing and running mobile phone systems," but brokers emerged to secure licenses to resell them. A flourishing secondary market emerged and demonstrated the enormous profits that could be made selling licenses.[199]

In 1993, again in response to new technologies and efforts to capture more of the rents associated with the spectrum, the FCC used auction allocation for unused spectrum (previously withheld for military use) for cellular telephones, fax, and wireless internet service. The nature of the right was not changed; it remained a use privilege. In 1997 Congress authorized further auction of broadcast licenses.[200]

Auctions account for only 2 percent of the total radio frequency spectrum, and access to some auctions was limited to designated parties, such as women and

[196] The Fourth National Radio Conference, the government assembly responsible for crafting the new legislation, passed a provision including the public-interest test shortly after receiving a resolution the National Association of Broadcasters had passed suggesting it (Hazlett 2001, p351).

[197] White (2000, p14).

[198] Hazlett (2001, p353). More market driven approaches in NZ, Australia, and Latin America.

[199] McMillan (1994, p3).

[200] Cramton (1997, pp431–495).

minorities.[201] Set-asides, price preferences, or instalment payments plans were used for targeted firms. The FCC also gave premium license acquisition terms to companies who developed pioneering technologies, a practice known as pioneer preferences.

The FCC has been more lenient with authorizing auctioned licenses to be subdivided and subsequently leased by licensees. In the case of cellular telephony the Commission has allowed licensees to slice spectrum into increments of any size and to occupy or lease those increments more or less as they see fit.[202] More lenient regulations also apply to Direct Broadcast Satellite (DBS).[203] These options strengthen use rights, and huge values are involved. The use of lotteries and auctions as allocation mechanisms to new spectrum and the assignment of more definite property rights as resource values rise are consistent with the predictions outlined in Section II.

6. ALLOCATION OF AIR POLLUTION EMISSION PERMITS

Early regulatory efforts to reduce air pollution in the United States were costly and not effective. They relied on relatively inflexible, uniform air quality standards and required that polluting firms meet them. Regulation included rules on emissions, equipment to be used, such as types of scrubbers and performance standards. The uniform rules did not recognize that the costs of controlling emissions varied across and within firms. Traditional regulation gave advantages to old plants and technology. There were no incentives to develop new technologies, and central regulation was often used politically to disadvantage certain firms and regions at the behest of entrenched interests with little environmental benefit.[204] Beginning in the mid-1970s dissatisfaction with the costs and performance of centralized air pollution regulation led to the adoption of emission trading programs, despite some resistance from regulatory agencies.[205] The relatively late turn to property institutions follows the timing predictions described earlier.

Under the pollution permit system, an annual targeted level of emissions is set and then prorated across permit holders, who are allowed to discharge a specified amount of pollution.

The permits have been allocated through first-possession, based on past electricity production, heat generation, fuel use or emissions, free of charge. There more information about production and fuel use than for past discharges. In some cases, a small portion, about 2 percent, have been auctioned to provide flexibility and to allow new entry by firms that did not have production histories. Since auctions were not used, the private sector received the scarcity rents. Some have criticized this outcome because of transaction costs of exchange and the ability to use auction proceeds rather than distorting taxes to finance the program.[206]

Emission permits are a right to use the air to discharge waste products in production. They can be traded, although under the EPA emission trading program each time a permit is traded the authorized pollution under the permit is reduced by 20 percent, discouraging exchange. As with all of the resources described thus far, except oil, they are use rights only, not a property right to the air. Their value depends on their security, the longevity of the program, and the ability to trade and bank. Where these have been constrained, values have been lowered.

The use of emission permits provides incentives for greatest reduction in pollution by those firms that can do so at lowest cost. Rather than equating pollution levels across firms, these instruments equalize incremental costs across firms to reduce pollution so that marginal abatement costs are equalized. Differential abatement cost information

[201] Hazlett (2001, p415).
[202] Shelanski and Huber (1998, p593).
[203] Shelanski and Huber (1998, p594).
[204] Pashigian (1985).
[205] Dewees (1998).
[206] Fullerton and Metcalf (2001).

was not generated under central regulation. Those firms with pollution below their allowable allotments can sell the residual emission rights, apply them to offset excess emissions in other parts of their operations, or bank them. Other firms can buy them, and an active market has developed in most emission systems where tradable permits have been used.[207]

Two of the most successful programs were those authorized under the 1990 Clean Air Act Amendments to allow electric utilities to trade allowances to emit sulfur dioxide, SO_2, to reduce acid rain and the Los Angeles basin, RECLAIM (Regional Clean Air Incentives Market) program.

6.1 SO_2 and NO_x allowance trading

This program is the centerpiece of Title IV of the 1990 Clean Air Act Amendments. The objective was to reduce SO_2 and NO_x emissions by 10 million and 2 million tonnes respectively from their 1980 levels. These are the principle gases associated with acid rain and they largely were emitted by electrical utilities. Two phases were used. Phase I, which ran through 1995, assigned emission permits to over 400 electrical generating plants and Phase II, which extended regulation to almost all generating units.[208] Total emissions were gradually reduced each year to achieve the targeted level. Within the annual total, tradable emission permits were allocated across generating units.

The emission permits explicitly are not a property right: "An allowance under this title is a limited authorization to emit sulfur dioxide...Such allowance does not constitute a property right.[209] Emission permits were allocated based on first-possession so that existing polluters were grandfathered and newer units were disadvantaged. Units that began operating in the year 1996 or later were not allocated any units, but were to purchase their allowances on the open market.

Phase I allowances were allocated free of charge based on past power generation as indicated by heat input. The allocation formula granted emission rates of 2.5 pounds of SO_2/mmBtu (million British thermal units) of heat input, multiplied by the unit's baseline, mm Btu (the average fossil fuel consumed from 1985 through 1987). Some variations were allowed in part to make the program politically viable and to encourage investment in new and renewable energy technology. Accordingly, utilities in certain states such as Illinois, Indiana, and Ohio were allocated an additional 200,000 allowances annually during Phase I. In these states there were important coal interests and all had ranking members or chairs of key Congressional subcommittees.[210] Additional allowances were granted to plants where scrubbers had been installed that reduced SO_2 emissions by 90 percent and to plants where emissions were reduced through use of renewable energy. A small portion of the allowances, 2.8% of the total allowances for a year, were auctioned by the EPA.[211]

Phase II allowances are part of a tighter overall annual emissions cap. The formula used in determining the initial allocation took an emission rate of 1.2 lbs of SO_2/ mmBtu of heat input, times the unit's baseline. As with phase I, exceptions and additional allowances were made for political and technical reasons. For instance, additional allowances were allocated to units that did not perform at their capacity during the base year due to equipment malfunctions. Greater allowance allocations were granted to smaller units.[212] An 'opt-in' program also was used to encourage very low-polluting utilities to enter by granting them allowances which could be traded to others. The flexibility underlying the tradable emission permit system overcame

[207] Tietenberg (2003, p12), Stavins (2003, p4).
[208] Stavins (1998, pp6-13).
[209] 104 Stat 2591.
[210] Ellerman (2000, pp40-43).
[211] Ellerman (2000, pp8-9).
[212] Ellerman (2000, pp43-48).

political opposition to the ambitious air pollution reduction objective. There are various estimates of the cost savings of the program, but they range from US$5 to US$12 billion over a central regulation alternative.

6.2 RECLAIM (THE REGIONAL CLEAN AIR INCENTIVES MARKET)

This program was established in January 1994 to reduce NO_x and SO_2 in a four-county area in the Los Angeles basin to meet federal and state clean air standards by 2010.[213] The basin has some of the country's worst smog or ozone levels, the only area to fall into extreme non-attainment for ozone. South Coast Air Quality Management District (SCAQMD) sets total emissions set annually and tradable emissions permits granted to the largest fixed facilities emitting pollutants, as well as brokers, and environmental groups. Allocation is also first-possession, based on historical emissions—peak emissions activity between 1989 and 1992. Each facility received an allocation for each year between 1994 and 2000 based on a constant rate of reduction (7.1 percent for NO_x and 4.1 percent for SO_x). For the years 2001 to 2003, the allocation levels were decreased further (8.7 percent in NO_x and 9.2 percent in SO_x).[214]

7. ALLOCATION OF ITQS IN FISHERIES

Wild ocean fisheries are the classic open-access resource with over entry, over fishing, over capitalization, falling catch per unit of effort, and depleted stocks. These conditions follow from the fugitive nature of offshore species, huge distances involved, overlapping political jurisdictions, and large numbers of heterogeneous, competing fishers.[215] Unfortunately, the implications of open access have been understood for a very long time. Scott Gordon described it in 1954, yet 46 years later, Grafton, Squires, and Fox (2000), could still describe the dramatic wastes of over fishing and regulation in the Pacific Northwest halibut fishery, and a 2003 Nature article by Myers and Worm (2003) could report that the world's major predatory fish populations were in a state of serious depletion.[216]

Historically, the initial regulatory response has been to deny access to certain groups based on political influence—non-citizens with expansion of the Exclusive Economic Zones (EEZs), sports versus commercial fishers, inshore versus offshore fishers, large-vessel versus small-vessel fishers, or vice-versa, and so on. This action temporarily reduced fishing pressure, but it did not solve the fundamental problem which is that rents exist for those who can find ways around the regulations.

As these failed, new regulations such as fixed seasons, area closures, and gear restrictions were put in place. These arrangements are politically attractive to regulators because they do not upset status quo rankings, minimize existing transaction costs, and call for major regulatory mandates, which are attractive to regulators and politicians. But they have not been successful. They do not align the incentives of fishers with protection of the stock. Further, given heterogeneous fishers and limited and asymmetric information about the stock and the contribution of fishing relative to natural factors, there are disputes about the design and efficacy of these regulations. Finally, there is no basis for fishers to contract among themselves to reduce fishing pressure and thereby to capture the returns from an improved stock. There are no property rights to exchange.

There has been a turn to individual transferable quotas (ITQs) in some fisheries, almost always after continued declines in the stock under centralized regulation, a

[213] Gangadharan (2004).

[214] Fromm and Hansjurgens (1996, p373; Regulation XX, Rule 2005.)

[215] Libecap and Johnson (1982), Leal, (2005), Tietenberg (2003, pp5-12) and Hannesson (2004) for discussion of the emergence of various regulatory/property regimes.

[216] A similar conclusion for deep-sea fisheries was reported by Devine, Baker and Haedrich (2006), also in *Nature*.

finding consistent with the predictions outlined in Section II and practices with other resources. ITQs require restrictions on entry, the setting of an annual total allowable catch, TAC, the allocation of rights or quotas to a share of the TAC, and enforcement. As such, ITQs are a usufruct right—the right to fish—not a right to the stock and the aquatic habitat. This limited rights arrangement is similar to western United States water rights, United States spectrum allocations, and pollution emission permits.

The more secure, definite, durable, divisible, and permanent the ITQ, the stronger is the property right. And stronger property rights better link the incentives of fishers with the goal of maximizing the economic value of the fishery. Government regulators still determine the annual catch and then distribute that catch among ITQ holders. With permanent and transferable catch quotas, the quota holders find it to their advantage to preserve and if necessary rebuild the marine resources. The value of the share of the TAC depends on the state of fish stocks and the sustainability of the fishery.[217] Enforcement costs may decline relative to those under other forms of regulation because fishers have a stake in the preservation of the stock as shareholders in the right to fish and self-monitor.

The allocation of ITQs, however, is controversial because it implies a more permanent, transparent private claim to resource rents than exist under open-access or central government regulation. And some parties who are excluded or affected by changes in fishing practices are made worse off. These effects have important wealth and political distributional implications that affect the timing and nature of the ITQ system adopted.

Established fishers with a history of fishing are the most formidable constituency in ITQ allocation discussions, and these fishers benefit from quota distributions based on historical catch and past vessel and gear investment (first-possession rules). No ITQ could be implemented in a fishery where the interests of established fishers are ignored or importantly compromised. For that same reason, uniform quota allocations or auctions are more likely to be used in new fisheries where there are no established fishers.

There is more than political expediency in the allocation of ITQs based on historical catch. As outlined above, it can be efficient as well. Assigning quotas to those with knowledge and past experience in the fishery likely is consistent with granting rights to the low-cost users. This practice reduces the need for subsequent reallocation and therefore, economizes on transaction costs. Reserving the fishery rents to fishers, rather than granting them to the state via auctions, also, enhances long-term incentives of fishers for protection of the stock and provides incentives for investment. Collaboration between fishers and regulators in setting the TAC not only reduces resistance to the catch limit, but incorporates stock and habitat information collected by the industry.[218] A portion of fishery rents often are taxed to cover at least some ITQ administration costs.

Other parties, such as processors and other input suppliers (crews, dock owners, boat and equipment sellers and support providers) and their communities, however, may be adversely affected by changes in harvest patterns made possible by ITQ regimes. There is a change in the composition of resource users with successful ITQs. An important efficiency gain from mitigating open-access is reduced labor and capital requirements, but these benefits will not be captured by those who have redundant supplies under the new arrangement. There are additional concerns that transferability

[217] Arnason (2002, p1).

[218] See criticism of grandfathering in Fullerton and Metcalf (2001). Johnson (1995) discusses the importance of heterogeneous inputs, input rents beyond fishery rents, and the non-neutral impact of a tax on quota value. Such a tax would result in adjustments in fishing effort and desired stock that could undermine conservation objectives. An auction that transferred quota value to the state could have a similar impact. See Grafton (1996) for comment and Johnson (1996) for reply.

of quotas and associated consolidation of the industry, which also bring efficiency gains, will gradually squeeze out small vessel owners. Indeed, the concerns of these groups who anticipated being harmed by ITQs led to a four-year moratorium on their expansion in the United States in 1996 under the Sustainable Fisheries Act (PL 104-297). Regulators also may resist ITQs because of a potentially reduced regulatory mandate or diminished ties to specific constituents that become less active in the fishery under the ITQ.

These allocation issues are similar to those that moulded the timing and nature of oil field production controls in the United States where the concerns of small producers led to exemptions and delay in adoption of mandatory unitization laws in Texas. Similar allocation concerns also arise in water, where transfers are restricted to protect rural community interests.

The following summarizes selected ITQ allocations and the strength of the property rights granted in fisheries in five countries, Australia, Canada, Chile, Iceland, New Zealand, and the United States.

7.1 Australia

There are at least 20 ITQ-managed fisheries in Australia, covering about 34 percent of the volume and 22 percent of the value of the country's fisheries.[219] They involve both state-inshore and federal (commonwealth)-off shore fisheries. The dominant allocation method is first-possession based on historical catch. Prior investment plays a smaller role. There are equity considerations in certain fisheries leading to equal or uniform quota distributions and/or restrictions on the maximum and minimum amounts of quotas that can be held as well as requirements that quotas be exchanged only among license holders. Allocations of ITQs are without charge, although standard income and capital gains taxation apply, and there is some administrative cost recovery through license fee charges. ITQs in Australia are comparatively strong property rights, being permanent, divisible, and transferable, and apparently can serve as collateral for long-term loans.

One important ITQ fishery is the Southern bluefin tuna fishery, where ITQs were implemented in 1984 after serious deterioration of the stock. Quotas were allocated to all significant participants in the fishery who had landed at least 15 tonnes during the three seasons prior to 1984, based on formula of 75 percent catch history and 25 percent value of vessels. Another is the Southeast trawl fishery, where ITQs were adopted in 1992 in the face of declining stocks. The allocation rule weighed historical catch by 70 to 80 percent (depending on the trawl type) and 20 to 30 percent on past investment. A third ITQ fishery is the Southern Zone rock lobster fishery. After stocks crashed in the 1980s a TAC was set in 1992-3 and ITQs allocated in 1993-4. They initially were allocated based on past catch or pot share of total catch, but modified in 1994-5 to assign an equal share of TAC per pot, but the number of pots varied among license holders based on past practices. Hence, the allocation rule remained based on historical catch. Limitations were placed on the maximum and minimum number of pots that could be held by any license holder. Until 1998, quotas were transferable only among family members, but thereafter among any license holder.

7.2 Canada

There are ITQs in about 40 fisheries in Canada, accounting for over 50 percent of the value and volume of landings.[220] In established fisheries, allocations are based on historical catch, modified by vessel size, capacity, and recent investment. The quotas are granted without charge. Most quotas, such as those for Pacific halibut (1991) and

[219] Arnason (2002, pp3-11).
[220] Arnason (2002, pp12-17).

sablefish (1990), were adopted between 1982 and 1998. In one newer fishery, the North Atlantic shrimp fishery, a uniform quota allocation of the TAC was used. In that fishery there are a small number of licenses and limited historical catch records. This practice follows the prediction described earlier. ITQs as property are weaker than in Australia. They do not have the legal status of property, but rather held as a use privilege, subject to renewal and regulation. In most fisheries there are no limits on number of quotas that can be held, but there are no guarantees of permanence. Their term is the same as the fishing license, which generally is more or less automatically renewed.

7.3 Chile

In 2002, there were four ITQ fisheries in Chile, the squat lobster, yellow prawn, black hack, and orange roughy.[221] The squat lobster and yellow prawn ITQs were adopted in 1992 and 1997 following sharp declines in the stock and the black hake and orange roughy ITQs also in 1992 and 1997, as newly developing fisheries. Unlike the Australian and Canadian systems, initial allocation was by auction, followed by annual auctions of 10 percent of the outstanding quota shares. There are few participants (less than 10) in each of these fisheries so that allocation issues may have been less contentious. ITQs have durations of 10 years, but do not have the status of property in Chile with fisheries held as public resources, although the right to fish under an ITQ is property. The ITQs are perfectly transferable, divisible, and are not linked to a vessel. There are no maximum limits on the number of quotas that can be held by a firm, but during the annual auctions no firm can bid for more than 50 percent of the TAC. Based on the success of these ITQs, they were to be extended to other established fisheries, such as the horse mackerel fishery. There are existing firms and they may be more numerous than in the other fisheries. Hence, ITQs are to be allocated based roughly on 50 percent weight on historical catch for the past four years for purse seiners and past two years for trawlers, and 50 percent vessel hold capacity. There are restrictions on transferability to existing fishers.

7.4 Iceland

Iceland is one of the first countries to adopt ITQ's.[222] Herring quotas were implemented in 1975 and 1979; quotas in the capelin fishery in 1980 and 1986; quotas in the demersal fisheries in 1984; and ITQs to all fisheries in 1991. 16 species are covered for 95 percent of the volume of the total catch. The quotas were granted without charge and include a right to catch a given proportion of the TAC every year. TAC shares are divisible and transferable. In the demersal, lobster, scallop, and deep-sea shrimp fisheries, ITQs were allocated on the basis of vessel historical catch, 3 years prior to quota system adoption. In the herring and inshore shrimp fisheries, where smaller vessels may have predominated, there were initially equal shares for eligible vessels. There have been some restrictions on the transfer of annual quotas between geographical regions to protect local employment, and recent requirements that vessels holding quotas must be involved in harvest, a type of beneficial use requirement like that found in western United States water rights.

7.5 New Zealand

New Zealand is also one of the first countries to adopt ITQ systems.[223] After declines in deep water stocks within the 200-mile EEZ, New Zealand adopted ITQs in 1983 based on 1982 catch volume and vessel capacity. In 1986 an inshore ITQ system was adopted for vessels active in 1985 based on 1982-4 catch histories. In both the offshore

[221] Arnason (2002, 18-23).
[222] Arnason (2002, 24-33).
[223] Arnason (2002, 45-51).

and inshore fisheries ITQs initially were fixed quantities, but these were changed to shares in 1990. Equity concerns led to assignment of 40 percent of the quota to the Maori. The ITQs are permanent, divisible, and transferable, with no restrictions on trade among participants. The rights apparently are as secure as those that exist for land. The rights security is similar to that found in Australia.

7.4 United States

ITQs are more limited and are a weaker property right in the United States than in many other major fishing countries.[224] Only four United States marine fisheries operate under such regimes: the Mid-Atlantic surf clam and ocean quahog fishery, the Alaskan halibut and sablefish fishery, and the South Atlantic wreckfish fishery, all adopted in the early 1900s. Two extensions were under consideration in 1995 for the Gulf of Mexico red snapper and Pacific sablefish fisheries, but tabled with the 1996 Congressional 4-year moratorium on further ITQs. The ITQs are a permanent share of the TAC, divisible and tradable. They are allocated on the basis of historical catch at no charge. For example, in the quahog and surf clams fisheries, quotas were allocated on the basis of vessel catch 9 years prior to introduction of the program, 1979-1987, for quahog and 4 years catch history during 1986-89 for surf clam. The quotas can be held by non fishers, and there are no restrictions on transferability. In the Atlantic wreckfish fishery, half of the TAC allocation was based on vessel catch recorded in 1989 or 1990 and half was equally allocated to all vessels that had a catch of 5,000 bounds prior to 1991. Transfers are unrestricted within the management area.

In the Alaska halibut and sable fish fisheries, allocations went only to vessel owners who had landings during 1988-90 (historical catch) and were based on the best five of seven harvest years between 1984 and 1990 for halibut and best five of six harvest years between 1985 and 1990. Quotas go the vessels and owners must be on the vessels (a type of beneficial use requirement). Part of the halibut TAC is reserved for community development quotas. ITQs in these two fisheries are weaker than in the others. There are restrictions of transferability to those in same management area and vessel class involving fishers with 150 days commercial fishing and there are minimum and maximum quota limits.

8. CONCLUDING REMARKS: SUMMARY AND IMPLICATIONS FOR FUTURE ITQS IN FISHERIES

Table 1 summarizes practices across the five resources with respect to the nature and strength of the property right granted, timing, allocation mechanism, existence of incumbents and high resource values and political constraints.

As shown in the table first-possession allocation rules dominate, and property regimes are adopted late in resource use and common-pool losses. Where incumbent users existed at the time of establishing the rights regime, first-possession was employed. There is also recognition for past investment. Auctions are adopted very infrequently, only for fringe allocations where there are no incumbents and where resource values have been shown to be very high, as in the case of the radio spectrum. Although first-possession is criticized by many economists as being inefficient, its empirical regularity suggests that there are efficiency advantages beyond political expediency. Except in the spectrum where transfers of spectrum rights have been restricted historically (except for recent auction allocations) and in water where long-term trades that change nature and location of use are subject to regulation, transaction costs of exchange appear to be low in most resources. Accordingly, initial rights assignments could be re-deployed with comparatively low transaction costs regardless of the allocation rule.

[224] Arnason (2002, 52-7).

TABLE 1
Summary of allocation mechanisms and strength of property right for five natural resources

Resource	Nature of the property right	Timing in assignment	Allocation	Incumbents, high resource values?	Political constraints
Oil and Gas Unit Shares	Full, legal property right	Late in resource use and common pool losses	First Possession (Rule of Capture)	Incumbents	No restrictions on trade Small producers granted preferences in regulation and restrictions on mandatory unitization laws in Texas
Water Rights	Use rights Used as collateral for short-term loans only Value capitalized in land value	Early allocation but quantification comes late	First Possession (Priority)	Incumbents	Trades affecting time, nature, and location regulated Public trust doctrine review
Air Emission Permits	Use rights Explicitly, not a property right	Late in resource use and common pool losses	First Possession Limited (2.8%) Auction in Phase I	Incumbents Auction (extra or fringe permits, no incumbents, high values)	Some preferences to coal using states in SO_2 permits More restrictions on banking in RECLAIM
Radio Spectrum	Use rights Explicitly not a property right to the spectrum	Administrative allocation early, lottery and auction late	First Possession Administrative allocation Limited lottery and auction (2%)	Incumbents Auction (new spectrum, high value)	Incumbent broadcasters benefited under allocation and regulation to limit entry Auction set asides for designated groups
Certain Fishery ITQs					
Australia	Use rights Legal property right	Late in resource use and common pool losses	First Possession (historical catch, some past investment)	Incumbents	Some quota trade restrictions
Canada	Use rights Not property	Late in resource use and common pool losses	First Possession (historical catch and past investment and vessel size) Uniform allocation	Incumbents New fishery	Some quota trade restrictions
Chile	Use rights	New Late in resource use and common pool losses	Auction First Possession (historical catch and vessel size)	High value Incumbents	Some quota trade restrictions
Iceland	Use rights Fairly strong property right	Late in resource use and common pool losses	First possession (historical catch, vessel size)	Incumbents	Some quota trade restrictions
New Zealand	Use rights Legal property right	Late in resource use and common pool losses	First Possession (historical catch and past investment)	Incumbents	Some quota trade restrictions Reservation of quota share for Maori
United States	Use rights Uncertain	Late in resource use and common pool losses	First Possession (historical catch)	Incumbents	Some quota trade restrictions Community quota reservations Actual fishers.

Hence, stickiness of use based on initial rights assignment is unlikely to be a major source of efficiency loss. Granting rights to incumbents who have experience in the industry appears to be consistent with an assignment to high-value, low-cost users. The state, of course, does not receive the rents when rights are awarded at no cost, as it would with an auction or with taxes on quota value. These practices reduce the interest

of the users in protecting and investing in the resource stock. And it is not obvious that politicians and regulatory agency officials would apply the revenues to achieve distributional or efficiency objectives.

There is the potential for waste due to a race to establish credentials for the subsequent assignment of use rights if first-possession is known to be the allocation rule and the parties are homogeneous. Just how important this problem is depends on the empirical case at hand. In general, for most of the resources examined here, there was a long history of prior use before the introduction of rights-based institutions and the claimants were heterogeneous. Hence, the real costs of race may have been comparatively low.

In every case except for oil and gas unit shares, the rights granted are use rights only. They are not a right to the resource itself. Political interests have influenced the nature of the regulatory system and the rights that are possible under it. This is observed in oil and gas regulation and unitization legislation as well as with reservations of rights to certain groups in some fisheries and small parts of the radio spectrum. In some cases the use right is weak and uncertain due to state regulation under the public trust or public interest doctrines. Restrictions on entry to protect incumbent broadcasters under public interest regulation suggests that caution is order in predicting that public trust or interest regulation will advance public, as compared to private, interests in resource use. And regulatory constraints on trade likely lower the value of the use rights granted.

In terms of implications for future ITQs in fisheries, first-possession or historical catch will govern where there are incumbent fishers, as is most common. Uniform allocations will be granted in new fisheries and auctions in new fisheries where there are high-valued species. Preferential assignments to certain groups of fishers (small, community) and accompanying restrictions on exchange lower the value of the rights and the value of the fishery. They may be important for political support of the rights arrangement, but they come at a cost. Finally, the stronger the right, the better the arrangement will protect the long-term value of the fishery. A broad regulatory mandate in the public interest may not be consistent with maximizing the value of the fishery and its contribution to well being of fishers who are part of it.

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Customary/Indigenous allocation issues

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Kia ora. He mihi mahana ki a koutou na tenei uri o Ngapuhi. E nga iwi o te motu, e nga iwi o tea o...tena koutou tena koutou ten ara tatou katoa.

I am honoured, if not a little daunted, at the invitation to speak to you today. However, I do relish the opportunity to tell you the hugely exciting story that has arisen from "the sharing of the fish" in the Maori Fisheries Settlement in Aotearoa New Zealand and specifically the impact that this has had on the success of my Tribe, Ngapuhi.

While I am currently a Deputy Secretary, responsible for national operations and programme delivery with the Ministry of Maori Development or Te Puni Kókiri as it is usually known, for almost four years I was the Chief Executive (CE) of Te Runanga a Iwi o Ngapuhi (the Runanga) – the Ngapuhi Tribal Council, based in Kaikohe in the far north of the North Island.

The Runanga is the Tribal Authority responsible for the economic, social, cultural and spiritual development of the Ngapuhi Tribe and all of its descendants. In my time there, the Tribal body was very involved and influential in seeing the delivery of the Maori Fisheries Settlement and also rapidly building capacity in managing fishing assets. But today I stand before you, representing Ngapuhi as Ngapuhi, not as the CE of Runanga. I no longer hold any executive or directional role with my Tribe.

I have developed a conference paper which covers the history of the fisheries settlement with New Zealand's indigenous people. The paper presents a comprehensive overview of the intentions of the settlement, how it was put together and implemented. I hope that this will be a good reference for you and provide some of the detail that you policy leaders and thinkers so require.

In my time today I want to focus on the personal view of the effect of the fisheries settlement on Ngapuhi and the people in the fisheries industry, both Maori and non-Maori New Zealanders. And while there is still significant work to be done in gaining the same success in the customary share, as has been achieved in the commercial arena, this is a great story about successfully sharing some of the fish.

1. NGAPUHI POTTED HISTORY

Ngapuhi are renowned for innovation, adaptability and audacity. Ngapuhi has a colourful history. European settlement occurred first in our tribal territory and very quickly we became active traders with whalers, sealers, and eventually the burgeoning English colony on the east coast of Australia at Botany Bay.

As New Zealand towns grew Ngapuhi led the change in developing those new markets for our goods and services. Our people were leading protagonists in the musket wars in the early nineteenth century and in 1840, our Chiefs were instrumental and present at the signing of the Treaty of Waitangi, which is regarded as the founding document of our nation.

Today, Ngapuhi is the most populous of Maori Tribes in Aotearoa New Zealand. Almost 20% of all Maori are Ngapuhi with approximately 107,000 members. While about 20% of Ngapuhi live within the tribal boundaries (the 'winterless' far north of the North Island), it's estimated that 60% live in Auckland with the remainder spread throughout the rest of New Zealand, Australia and the world! Stacey Jones, the 'Little General' currently leads a Super Rugby League Club in France. Buck Shelford, both famous sportspeople; they're both Ngapuhi. And so too is the recently appointed CE of the Commonwealth Bank of Australia, Ralph Norris.

2. SOME FURTHER BACKGROUND

With the impact of urbanization and following World War II, many Ngapuhi, particularly in Auckland, were struggling (and continue to struggle) to meaningfully hold onto their Ngapuhi identity. For some, that struggle for identity has contributed to a sense of loss, exacerbating under-achievement, to the point that our negative social statistics (as for most Maori and other indigenous people the world over) is very telling. It has put a hand brake on achievement for Ngapuhi.

When I became CE of Ngapuhi, and faced with this reality, my strategic focus was on strengthening identity and providing Ngapuhi with the tools they required to strengthen their ties and reconnect with their Tribe.

2.1 What is Ngapuhi identity?

Over seven hundred years ago, our ancestors left Hawaiki, our place of origin, and settled in what was, and what is now, our tribal area. Since then, the Ngapuhi Tribe has steadfastly remained in the 'winterless' far north of the North Island. We have a long connection with our tribal lands and seas.

In essence Ngapuhitanga is a set of powerful concepts all interconnected with each other. Ngapuhitanga includes history, ancestors, song, dance, art craft, land, forests, waterways, seas and oceans.

Maori are tangata whenua, "people of the land". Tangata whenua also loosely translates to "indigenous" and each Tribe is tangata whenua to its own tribal boundaries. We have a special connection with the physical resources of our tribal boundaries. It is a unique sense of place.

Tribal boundaries, much like beautiful Ngapuhi women, have been fought over, defended, worshipped, celebrated and loved. Within these tribal boundaries, are where we have harvested, traded, developed, bred, lived and died since those first ancestors settled.

I know that many other cultures also have a strong sense of place that helps to make up their identity. However, our unique Ngapuhi culture, our identity, is defined by its place. So how do you reconcile this with the fact that our people are a diaspora spanning the globe?

The answer is by providing them with tangible and meaningful connections with their identity, where ever that may be. It is about equipping our people with a sense of identity so they can exude their Ngapuhi culture with confidence, where ever they are. For Maori, confidence is one's culture; in one's identity, it is very often a prerequisite to being successful in whatever chosen walk of life.

When identity is strengthened young people are assisted to start the journey of finding their own success and those already successful can be driven onto bigger and greater things. The Ngapuhi Tribal Authority has a very clear vision, which is that the sacred house of Ngapuhi, stands firm. The Authority's mission was and still is, to lead the spiritual, cultural, social and economic growth of Ngapuhi. The Authority faces a major challenge in that vision and mission.

Ngapuhi has a young population base. There is a burgeoning population of young Ngapuhi, who are more likely to be formally qualified than their parents. Being

young and more formally qualified in an educational sense, they are more mobile and are seeking careers that never existed in their parents' day! So the challenge of strengthening Ngapuhi identity among this changing group of young people is very real. To start with, young Ngapuhi need access to their whakapapa, their genealogy; they need to understand their families place in the Ngapuhi journey. In this context of building identity and a new confidence, for Ngapuhi the fisheries settlement was a catalyst, the first dawn of a new era in the history of Ngapuhi.

2.2 The fisheries settlement

To understand the 'first dawn', I need to share a very short account of the fisheries settlement. Actually, it was such a saga, that any account can only be short!

The establishment of the Ngapuhi Tribal Authority is completely intertwined in the history of the fisheries settlement. In 1988, Te Runanga a Iwi o Ngapuhi was incorporated as a Charitable Trust, it was also the year when the first interim fisheries settlement was made. I remind you that the fisheries settlement would not have happened unless the Treaty of Waitangi was signed back in 1840. The Treaty ceded New Zealand to British Authority but, guaranteed the Chiefs and Maori Tribes of New Zealand, the full exclusive and undisturbed possession of their lands, estates, forests, fisheries and other properties, for as long as Maori wished to retain them. Under the Treaty, Maori were granted "all rights and privileges of the British subjects" which was a major concession for indigenous people at that time.

For Maori, from 1840 onwards and until relatively recently, our history has been a procession of dispossession, both through voluntary exchange and injustice. But, in the 1980s, after nearly two decades of Maori activism and protest, the tide began to turn.

In 1986, Tom Te Weehi was charged with collecting undersized abalone. In Court, Te Weehi argued he was fishing in a customary Maori way and he was doing so with the permission to fish from an elder of the local South Island Ngai Tahu Tribe. He also said he was protected under the Fisheries Act which said nothing in the Act shall affect "Maori fishing Rights". Up until then, that Clause had been Law since the nineteenth century, but to little effect. The Judge ruled in favour of Tom Te Weehi saying that the Treat of Waitangi (1840) had preserved Maori fishing rights. It was a watershed decision of jurisprudence.

Initially, the decision was regarded as a non-commercial right for customary take. However, soon after that Court decision and, in a totally unrelated occurrence, the Government of the day came to the conclusion that all other methods of allocating fisheries rights had failed. The fisheries industry was not economically or environmentally sustainable. The Government then decided to introduce the Quota Management System.

To introduce the system, Government officials calculated how much was needed for recreational and customary Maori fishing and then allocated the rest to existing fisheries in proportion to their catch history. This quota could be traded like any other property. Fisheries who caught below a certain tonnage or did not have catch histories in the right years were deemed part-timers, had their fishing licenses removed and they were allocated no quota.

To make matters worse many Ngapuhi people were victim to this new round of dispossession. The Ministry of Fisheries noted that most of the 300 part time fishers who lost their licenses were Maori, supplementing their incomes from other part time activities such as shearing and freezing work. In late 1986, the Muriwhenua claim was presented to the Waitangi Tribunal. The Tribunal is a permanent commission of inquiry which investigates breaches of the 1840 Treaty. It also makes recommendation on redress for those breaches.

The unique thing about the Muriwhenua claim, was it was the first time Maori had laid claim to commercial fishing. Their claim was there had always been "a commercial

dimension to Maori fishing" and that Maori had never sold their rights to fishing. With the new quota system about to be introduced in October 1987, the Tribunal agreed to deliver a preliminary opinion. They found that the Muriwhenua Tribes made extensive fishing use of the sea to 12 miles and occasionally fished further out. They also found that the seas were property in the same way as land and the Tribes had the mana of that area. By mana they meant that Maori were able to exercise dominion over the zone or that they owned it. Right in the middle of the single biggest reform of commercial fishing in New Zealand's history, the tribunal opinion landed like a hand grenade.

The claimants marched straight to court. The High Court accepted that they did have proprietary rights which the Government had failed to take account of. Justice Greig granted an injunction that prevented the Minister of Fisheries gazetting the next batch of quota. It was time for the negotiations to begin. In essence, after a year of negotiations an interim settlement was agreed in 1989 allowing the quota management system to proceed with 10 per cent of the quota going to Maori via a new body, the Maori Fisheries Commission. Maori clearly weren't satisfied with just 10 percent, and the Government had a problem because to provide more would require them to buy quota on the open market which would be very expensive.

In 1992 an opportunity presented itself when a New Zealand corporation decided to sell its fishing subsidiary, Sealord which held about 22 per cent of total quota. A group of negotiators that was roughly representative of Maori Tribes cut a deal that had two major components. The first is that the Government would provide the cash to the Maori Fisheries Commission, now called Te Ohu Kai Moana, to purchase 50 per cent of Sealord. The second was Maori were to get 20 per cent of the quota of any new species brought into the quota management system.

2.3 The allocation

The 1989 interim settlement and the 1992 Sealord settlement brought to a close the negotiations on the amount of redress available to Maori. Te Ohu Kai Moana, the commission, now had to develop a means for allocating the settlement assets among Maori Tribes. That was 1992. In 2005 Ngapuhi were the first iwi to uplift our share of the assets. It took 12 years to work out how the allocation would work. And no wonder... Do you divide the assets by population, or do you divide the assets by coastline controlled in tribal boundaries?

On the basis that the settlement should benefit all Maori, suggesting equitable sharing or distribution of the assets, Ngapuhi advocated for a distribution model based on the tribal population. Ngai Tahu was a very influential Tribe in the settlement process as their coastline consists of virtually the entire South Island, including Fiordland and Marlborough Sounds, so, not surprisingly they wanted a coastline length-oriented allocation method. Also, some Maori leaders saw the settlement as an opportunity to build pan-regional Maori structures emancipated from tribal politics. Others saw the settlement as an opportunity to rebuild the tribal authorities and tribal mana.

In the end the final allocation settlement was a compromise between the all of these methodologies. The quota assets were handed back to Tribes. The fishing company shares in Sealord and a number of other fishing companies, subsequently acquired by Te Ohu Kai Moana, were retained in a single corporation called Aotearoa Fisheries Limited which pays its dividends to the Tribes.

It is amazing and a credit to Maori that we were able to settle on an allocation method at all. It is a triumph of compromise. I believe Ngapuhi pushed hardest for compromise. We always believed that the negotiations had the potential to damage all Maori. There was always the threat that the allocation negotiations would become a process for lawyers and not for Maori. Litigation without end was our collective enemy. That interim quota Ngapuhi received, at reduced lease costs from the Commission until final allocation, and the preparation for, and the receiving of the settlement assets

brings me back to the central theme of my talk today; the fisheries settlement was a catalyst, the dawn of a new era in Ngapuhi's development.

In saying that, I need to give you an idea of how successful Maori have been in the two decades of their involvement in the fishing industry. Today, Maori directly control one third of the industry through ownership of quota, and influence up to another 20 percent through leverage of their quota. The Maori fishing workforce has doubled as a percentage of the total fishing workforce from around 15 to 30 per cent, from 1800 to approximately 9000 workers. Maori are the dominant commercial force in New Zealand's fifth largest export sector, generating $1.3 billion in export revenue, double the amount in 1986. This is an inspirational achievement. It is a totem of success.

3. EFFECTS OF THE SETTLEMENT

Speaking for Ngapuhi, I will illustrate the effects of the settlement in a number of ways.

3.1 The settlement assisted the Tribe to come together and address significant issues collectively.

The settlement gave Ngapuhi a reason to come together and stay together and learn to work together to address significant issues. From 1945 to the 1980s, there was virtually no public role for tribal organizations or tribal committees. But, in the late Eighties, Ngapuhi has to set up a company (Ngapuhi Fisheries Limited) to manage its fishing activities.

The company needed to develop its own policies and strategies to address the settlement and allocation negotiation. Ngapuhi leadership was being tested in ways never contemplated before, which brings me to the second point; the impact of the settlement on developing Ngapuhi's governance capabilities.

3.2 A new focus on developing Ngapuhi's governance capabilities

Ngapuhi did not become instant experts in governance theory, however, Ngapuhi identified that governance capabilities in a number of areas, including establishing new democratic processes to elect representative was needed, if they were to hold assets on behalf of the Tribe! Ngapuhi needed to learn the skills of separating leadership and governance decisions from management decisions. Ngapuhi leaders also needed to learn the difference between the interests of beneficiaries of the Charitable Trust and the linked, but separate commercial interest of the Tribe's business activities.

Ngapuhi made some early 'mistakes' which looking back, were an inevitable part of developing governance capability. In 2001, after an extensive internal review, I was appointed CE of the Runanga. Fisheries income was the mainstay of the Runanga, but there were debts and a number of under-performing activities that were holding development back. I took a 'crash course' in the business of fishing!

3.3 Professionalising Ngapuhi's tribal management

Te Ohu Ka Moana provided Tribes with an income source by leasing quota at a discounted rate. In 2001, Ngapuhi decided to take its entitlement to this leased quota and sublease it to the market, using an open competitive tender process.

Additionally, with the application of more transparent management practices in the fishing company, a focus on quota exploitation through Joint Ventures, that year we made a remarkable turn around and showed a net profit of $1.5 m, all of which, went to the owner – the Tribal body! This was from a company which, in comparison, for the previous 10 years, had returned on average $50,000 to the Tribe.

With that, the debts were cleared, a sustainable income was secured and a fresh start was made. During my time as CE, I was privileged to work with Sonny Tau, a Chairman with considerable patience and wisdom. Together, we formed a strong

partnership that continued the professionalization of Ngapuhi's tribal management. Sonny continues as Chairman of the Runanga today and the management of the Tribal Authority remains thoroughly professional. And they need to be. Last year following the allocation Ngapuhi's fishing assets were valued at $66m!

3.4 The impact on regional economic development

It is interesting to note that in the early days there was an expectation that returning the assets to Maori would lead to an increase in the number of Maori fishing companies, and that would allow more to enter the industry. It didn't work that way.

Quota enabled fishers to cash up and get out of the industry, and if you had an uneconomic parcel of quota, you had the mechanism to do so. The quota system led to a consolidation of ownership. The Maori owned fishing companies, such as Moana Pacific and Sealord, participated in this quota consolidation. They then set about consolidating the number of fishing ports. There were people who felt aggrieved about this, but as Mangers, there was a duty to get the best return on our assets on behalf of all Ngapuhi.

However, we actively helped where we could. For example, we held back a proportion of the inshore quota and made that available at less than market price so the Ngapuhi fishers could continue to participate in the industry. Further, there is nothing like success to breed success!

The sustainable income from fishing meant Ngapuhi was able to increase their investment in collecting, recording and distributing Ngapuhi stories and history, which are fundamental to Ngapuhi identity. Owing to that, Ngapuhi has increased access to that, for its entire Tribe. There is new confidence among our people – a confidence borne out of success and achievements.

3.5 Assisting Ngapuhi to build connections with non-Maori institutions and businesses

With that new confidence has come the ability to build new business partnerships with non-Maori companies, with other Tribes, community groups, local government, Crown agencies and the Government. Ngapuhi engages as an equal, a peer, rather than a supplicant or a beneficiary. Ngapuhi has the confidence and the resources to build new connections and new relationships which can extend the development, interest and influence of Ngapuhi.

3.6 Restored Maori confidence in New Zealand's institutions, particularly the law and reducing the powerful sense of alienation and injustice

The settlement restored Maori confidence in New Zealand's institutions, particularly the law and reducing the powerful sense of alienation and injustice Maori have felt for years. Critically, the process of alienation and injustice felt by Ngapuhi has been reversed. For man the sense of dislocation, alienation, and injustice hasn't gone away, but it has reduced. Redress was sought at the Waitangi Tribunal with the High Court confirming that Ngapuhi had proprietary rights to the fisheries.

Rather than the Law being a mechanism for the dispossession of Ngapuhi, it became an institution the Tribe could respect. In the last twenty years, some of the best and brightest Ngapuhi have entered the legal profession. I have no doubt that their whanau, their families went to see Maori lawyers build on the institution that is the legal profession, thereby ensuring that all Maori have access to justice. This is an extremely healthy and inclusive force for the future of our country.

3.7 Building a global confidence that has enabled Ngapuhi to succeed

I believe the settlement process was a catalyst for the re-emergence of a global Ngapuhi confidence. It is a belief that Ngapuhi can perform on the global stage in every sphere

of business, sporting or cultural activity and that where ever its people are, they remain a member of the Ngapuhi Nation.

4. CUSTOMARY FISHING

Before I conclude, I should touch on customary fishing.

As I mentioned before, it can be argued that the Maori fisheries settlement stemmed from the defiance of a single customary fisher in the south Island, Tom Te Weehi. But conflicts remain on the shoreline of customary fishing.

As has been fully discussed at this conference, there is a continual tension between commercial, recreational and customary fishers. This is no less the case in New Zealand. What makes things particularly interesting is now that Maori interests are a dominant force in the commercial fishing industry, the growth of Maori customary and recreational fishing has the potential to reduce the value of the commercial assets. This tension is being arguably debated within Ngapuhi and Maoridom as we speak. The debates require significant leadership from both Government and Maori.

5. CONCLUSION

Ngapuhi quickly took to the business of fishing. It was like it ran in our blood.

In the relatively short time of one generation, commercial fishing has enabled us to invest in our leadership, management and services to our people. These services are targeted directly at supporting Ngapuhi identity development. But indirectly it has given us a new confidence and strengthened our sense of purpose which in its own way is invaluable for the identity of our people.

When we look to the seas and oceans we no longer see injustice and dispossession. Rather, we look out over the great expanses of the Tasman Sea and the Pacific Ocean and we see that we have a share in the future, that we have a means to participate in the sustainable development of an industry and our people. The sense of pride among our people is palpable. The benefits for Ngapuhi are obvious to see, but also the benefits to our nation are also significant.

Non-Maori business interests look at us as business partners they can trust because we have a track record of success and reliability. The people of New Zealand and the Government have benefited too, because what is more corrosive to a nation's future than people who feel alienated and dispossessed? The world has too many people who feel dispossessed and alienated and hatred and wars are the symptoms of this disease.

Today I believe for Ngapuhi this process has reversed. There is still a lot to be done. But we know we can meet the challenges of serving the Ngapuhi house to stand firm, even though our members stand all over the globe.

Allocation policies and its implications for recreational fisheries management in inland waters of Argentina

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ABSTRACT

The Northeast, Central, Western and Northwestern, and Patagonia and Tierra del Fuego regions dominate Argentina inland recreational fishing. Being each unique in terms of environmental context, fish fauna and fishery types. High species diversity, extractive fishing and highly priced fly-fishing catch and release fisheries characterizes the Northeast. The Central Western and Northwestern fisheries are extractive, targeting few species. Patagonia and Tierra del Fuego have extractive and catch and release salmonid fisheries on the Andes. There are extractive fisheries of native species on Atlantic drainages of northern Patagonia, and anadromous rainbow and brown trout fisheries on southern Patagonia and Tierra del Fuego.

In the Northeast, Central, Western and Northwestern regions conflicts between fisheries sectors (e.g. recreational vs. commercial) exist. In Patagonia and Tierra del Fuego conflicts within the recreational sector associated to fishery types and fisher philosophies (e.g. extractive vs. catch and release, highly price lodges vs. free access) predominate.

Allocations, where implemented are generally set by specific interest groups not as part of an official strategy. This is part of a broader problem namely lack of integrated approaches towards the sustainability of Argentina's inland recreational fisheries.

[225] The paper was delivered by Dr José Bechara on behalf of all the authors.

1. INLAND RECREATIONAL FISHERIES OF ARGENTINA: AN OVERVIEW

Recreational fishing in Argentina is an expanding activity suspected of a high economic turnover at the local, regional and national levels (Urzua Vergara, 1992; Vigliano and Alonso, 2000; Cleminson, 2000). The Northeast, Central, Western and Northwestern and Patagonia and Tierra del Fuego regions (Figure 1) dominate the scene of Argentina's inland recreational fishing. Each region has unique characteristics in terms of environmental and socio-economic context, fish fauna fishery types and conflicts, defining a complex scenario, where base line studies and management programs are still insufficiently developed to provide guidance to interested parties. In general terms in all three regions - and based on target species sought for, their characteristics, the type of fishing gear and fishers socio-economic level - five types of inland recreational fisheries can be recognized (Table 1).

World-class fisheries: Characterized by fishers of very high socio-economic level mainly from outside Argentina and some nationals, highly specialized in terms of gear used and services required, making use of exclusive fishing lodges and outfitters. Their fishing experience is mainly oriented towards top predators of trophy size fish and pristine environments with little human presence, being usually catch and release advocates. In some cases, the lack of trophy size fish may be replaced by a high daily capture of very hard to catch fish such as dorado (Salminus brasiliensis) in the Iberá wetlands (Northeast).

Recreational 1: Characterized by high socio-economic level fishers mainly nationals that use lower priced lodges and outfitters than the previous group, they also favour top predators and big size fish, being less specialized in terms of gear and uniqueness of the fishing experience, mostly advocates of catch and release.

Recreational 2: Upper middle-to-middle class socio-economic level national and international fishers from foreign countries. Generalist with regards to gear and services required targeting a wider range of species, which include predators, planktivorous, and omnivorous fishes, and seeking not only sizes but also numbers of fish, conformed by both catch and release and extractive advocates.

Recreational 3: Lower middle-class-to-middle-class local and regional extractive fishers that do not hire specialized services. The fishing experience is not necessarily centred on catching fish and may be more related to the possibilities of outdoor activities with family or friends. In terms of fish they seek numbers, targeting carnivorous, planktivorous, and omnivorous fishes.

Recreational 4. This fourth category has to be considered carefully because it is actually an extractive fishery, characteristic of highly populated areas where poor people target mainly detritivorous as well as omnivorous species, seeking numbers for consumption even

FIGURE 1
Inland Recreational Fishing Regions of Argentina: 1. Northeastern region, 2. Central, Western and Northwestern regions. 3. Patagonia and Tierra del Fuego regions

TABLE 1
General characteristics of Argentinean inland recreational fisheries

FISHERY TYPE	RESOURCE CHARACTERISTIC SOUGHT	TYPE OF TARGET SPECIES	MAIN TARGET FISH SPECIES OR SPORT FISHERIES	FISHERS SOCIO-ECONOMIC LEVEL	COMPETITION WITH COMMERCIAL AND SUBSISTENCE FISHERIES	ARGENTINEAN REGION	REGIONAL HUMAN DENSITY
World Class Fishing Lodges	trophy size high numbers of fish per day	top predators carnivorous	SALMONIDS Salminus	very high, international clientele and some nationals of high socio economic level	nule	Tierra del Fuego Southern Patagonia Ibera Swamps (Ne)	very low
Recreational: Fishing Lodges	large size fish	top predators carnivorous large omnivorous	SALMONIDS Salminus Pseudoplatystoma Piractus Brycon	high, national clientele of high socioeconomic level	very low	Northern Patagonia Parana-Paraguay Confluence Upper Bermejo And Upper Parana Rivers below Yacyreta Dam	low
Recreational 2	size and numbers of fish caught	predators planktivorous and omnivorous	SALMONIDS Odontesthes hatcheri Odontesthes onariensis Salminus Pseudoplatystoma Piarctus	upper middle class and middle class	low-middle	Northern Patagonia Pampa Plain Upper Middle Parana River	middle
Recreational 3	number of fish caught	carnivorous planktivorous and omnivorous	SALMINUS Pseudoplatystoma Odontesthes bonariensis	middle class-lower middle class	middle-high	Lower Middle Parana River Parana Delta Pampa Plain Western and Northwestern Reservoirs Yacyreta Dam (Ne)	middle-high
Recreational 4: (Banned for enironmental reasons)	number of fish caught	omnivorous but mainly detritivorous	Cyprinus carpio SMALL RIVERINE FISH	low-middle class and poor people	high	Rio de la Plata River	high

though fish species caught are usually banned for consumption due to environmental problems such as contaminants in fish flesh. Even though this type of fishery could be considered subsistence we have chosen to include it as recreational because it has no commercial value and people engaged in it have a mixed recreational subsistence view of it.

Preservation, recovery and improvement of natural resources are guarantee through the Argentine Constitution, the National Environmental Policy Law # 25.675, the National Parks Law # 22.351, the Wild Fauna Conservation Law # 22.421, Provincial constitutions and Provincial laws and regulations. Basically this body of norms state that natural resources must be managed as to preserve, recover or improve the quality of both natural and cultural resources promoting their rational and sustainable use. The provinces mostly regulate recreational fishing in Argentina, national law having precedence over provincial ones. Where interprovincial or international jurisdictions apply joint commissions are established to deal with conflicts and resource management.

2. NORTHEASTERN FISHERIES

Recreational fisheries of Northeastern Argentina have several distinctive features from the others of the country. The most remarkable is the large number of targeted species as a result of the high diversity of native Neotropical fish fauna. The most common fishery types are recreational 2 and 3. World class fisheries and recreational 1 have been growing during the last 10 years, with highly priced recreational fishing and international quality fishing lodges. Those fisheries rely mainly on dorado (Salminus brasiliensis), a highly valued species for fly cast due to its aesthetic, fighting and size attributes.

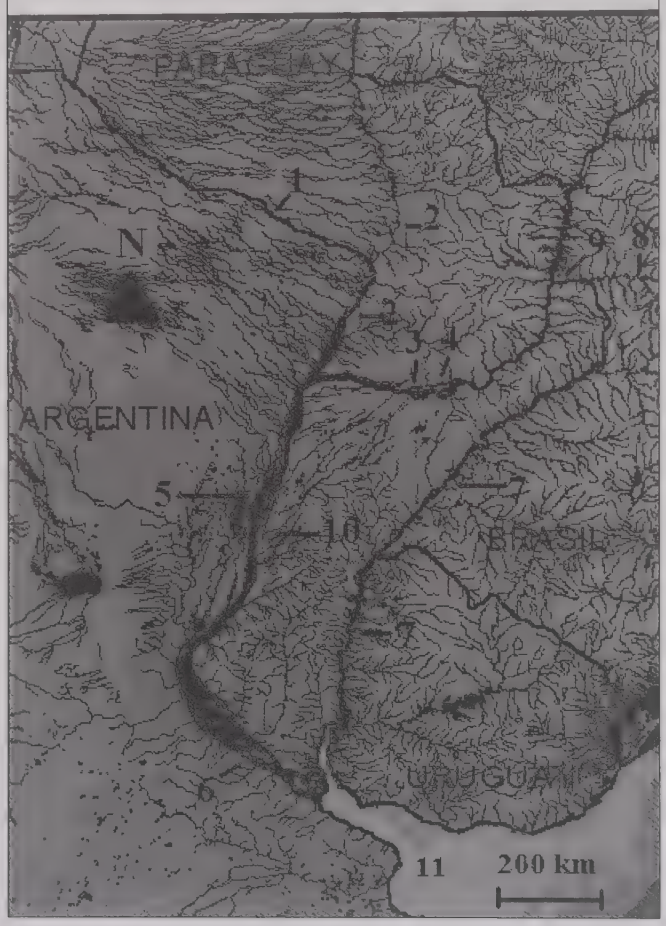
A second particular feature in the large rivers of the region is the existence of an important commercial fishing pressure, which generates frequent conflicts among fishers. Third, the region shares international waters in both, Paraná and Paraguay rivers (Argentina-Paraguay border), which is an additional source of conflicts. In Paraguay the main fisheries is commercial, but with an emerging number of World Class and Recreational 1 fisheries. Fourth, most of the fishing activities are carried out in the large rivers or in some of their affluents, with almost no recreational fishing in the abundant shallow lakes of the region.

Finally, fishing tournaments are very popular and numerous, at the point that every important fishing town of the large rivers has at least one annual competition.

As well as for most fisheries in Argentina, there are very few scientific or technical studies on Northeastern fisheries, and those available are mostly for commercial fishing. Even crude statistical data are also rare and hard to find. Most works were published in reports of limited diffusion or in regional scientific journals. Therefore, very little is known about the fisheries biology of the targeted species, the impact of the fishing and the evolution of exploitation rates.

North-eastern Argentina (Figure 1) comprises six different provinces (Misiones, Corrientes, Chaco, Formosa, Santa Fe and Entre Ríos), and is also named fluvial littoral region. It extends over 0,5 million km2, having a subtropical climate in the north that gradually changes to a warm temperate in the south. Population density is middle in the north to middle-high in the south (average of 16 inhabitants km2). The northern provinces of the region are among the poorest and less developed of Argentina, while the southern ones present much better human development. From the point of view of landscape, the region is placed in a transitional zone, moving from the Paraná subtropical rainforest in the north-eastern hills of Misiones Province and from Chaco dry forest in the plains of the north, to the Pampas plains in the south and south east. Many ecotonal landscapes develop between those major biomes.

FIGURE 2
Hydrology of the Northeastern region: 1. Pilcomayo river, 2. Paraguay river, 3. Upper Paraná river, 4. Yacyreta dam, 5. Middle Paraná river, 6. Lower Paraná river and delta, 7. Uruguay river, 8. Iguazú river, 9. Iguazú falls, 10. Corrientes river, 11. Río de la Plata river. (Modified from USGS Global GIS Data Base. Digital Atlas of Central and South America)



The entire region belongs to Del Plata Basin, which is the second largest watershed of South America after the Amazon. This basin comprises two of the most developed regions of the subcontinent, placed at the headwaters (Sao Paulo, Brazil) and the Río de La Plata and Paraná River delta mouth (Buenos Aires, Argentina).The major watershed within the basin corresponds to the Paraná River (Figure 2), which has important affluents such as the Iguazú and Paraguay rivers. Other minor tributaries are also important for recreational fisheries such as the Yabebiry (Misiones Province), Corriente and Santa Lucia Rivers (Corrientes Province), Salado and Colastiné (Santa Fé Province). The Paraná and Iguazú rivers have been heavily dammed and they are highly regulated by headwater dams in Brazil. This fact may be one of the reasons for a decline in population size of some valuable species, particularly omnivorus/frugivorous (Piaractus and Brycon) (Quirós, 1990).

Due to its size and complexity, the Paraná River can be divided in several reaches with their particular ecological features and recreational fisheries types. From the mouth of the Iguazú River up to Posadas City (Misiones Province), the river runs along a narrow and deep canyon almost without floodplain areas. From Posadas to Ituzaingó, the large reservoir created by Yacyretá Dam (1 140 km^2) dominates the scene, forcing fishermen to completely different fisheries styles since 1994. From this dam to the confluence with the Paraguay River the river has an anastomosed channel with important development of floodplain sectors and islands, as well as areas of rapids with bedrock outcrops. All these reaches belong to the so-called Upper Paraná River. Below the Paraguay River embouchure begins the Middle Paraná River, it has a large mean discharge (17 000 m^3 at Corrientes City) and a huge fringing floodplain attaining 100 km wide in some sectors. The most developed region of the country is the lower portion of the Middle Paraná, the Delta and the Rio de la Plata, but it is also the most heavily polluted, with organic contaminants widely incorporated by fish (Colombo *et al.* 2000), a fact that precludes fishing for massive consumption. Paradoxically, waters from the Paraná River are mostly oligotrophic or mesotrophic. However, in the last years, large blooms of cianobacteria (mainly Microcystis aeruginosa) have been observed in the upper and middle sectors, probably related to upper dams and the growing load of wastewaters effluents.

The other major river of the region is the Uruguay, which is also dammed, but bears a far less important development of recreational and commercial fisheries.

The Paraguay River basin is mostly undammed and unregulated, draining the Gran Pantanal waters in Brazil. This meandering river has a large alluvial plain, and collects

TABLE 2
List of the most important recreational target species in North-eastern Argentina, with some relevant data on sizes and some regulations

Order	Scientific name	Spanish common name	Habits	Minimum allowed length1 (total length, cm)
Characiformes	*Salminus brasiliensis*	dorado	potamodromous, top predator	75
	Piaractus mesopotamicus	pacú	potamodromous, omnivorous/ frugivorous	45
	Byrcon orbignyanus	pirá pita, salmon del Paraná	potamodromous, omnivorous/ frugivorous	45
	Hoplias malabaricus	Tararira	non migrant, lake dweller, top predator	–
	Leporinus obtsudiens	boga	potamodromous, omnivorous	45
Siluriformes	*Pseudoplatystoma corruscans*	surubí a lunares	potamodromous, top predator	85
	Pseudoplatystoma fasciatum	surubí atigrado	potamodromous, top predator	80
	Paulicea luetkeni	manguruyú	potamodromous, top predator	100
	Zungaro zungaro	manguruyú abá	potamodromous, top predator	40
	Luciopimelodus pati	patí	potamodromous, top predator	70
	Hemisorubim platyrhynchos	manduré tres puntos	potamodromous, top predator	35
	Sorubim lima	cucharón	potamodromous top predator	40
	Pimelodus albicans	moncholo	potamodromous, top predator	30
	Oxydoras kneri	armado chancho	non migrant, benthic feeder	45
	Pterodoroas granulosus	Armado común	potamodromous, omnivorous	35
	Pimelodus maculates	bagre Amarillo	potamodromous, benthic feeder	25-30
Perciformes	*Plagioscion ternetzi*	corvine	non migrant, top predator	30
Atheriniformes	*Odontesthes bonariensis*	pejerrey	non migrant, lake dweller, planktonic and benthic feeder	–

1= May vary according to provinces and type of fishing.
"–"= not found.

waters of two important affluent from Andean mountains: the Bermejo and Pilcomayo rivers.

The Paraná River geological activity during the Pliocene and Pleistocene at Corrientes Province has brought a large alluvial fan which abandoned beds and levees constitute the large Iberá marshland complex and related wetlands (Popolizio 2003). Some of these wetlands are pristine, and protected as provincial reserves or national parks. They are fed mostly by local rains with ultraoligotrophic or distrophic waters, with sandy bottoms widely covered by large floating peat soils. The most important wetland is Iberá, which comprises an area protected by a Provincial Reserve of 12 000 km^2, part of it belonging also to a Ramsar site.

Alluvial fans are also important in Bermejo and Pilcomayo Rivers, which have a large load of suspended solids (mostly colloidal clay). The old channels of these rivers in the Chaco encompass today important areas for fish reproductive migrations and spawning, and are exploited by type 3 Recreational fishers. All the fish of the area are also important to subsistence fisheries of aboriginal populations.

This region possesses by far the highest fish diversity of Argentina, which consists of about 350 fish species, being exotic only four of them (López *et al.* 2005). Just in 12 000 km^2 of Iberá marshlands, more that 111 species have been described (Casciotta *et al.* 2006). Most species belong to the group of tetras and related species (Characiforms), as well as catfishes (Siluriforms of several southamerican families). About 20 species are the most important in recreational fisheries (Table 2), while other 10 are used as living baits.

Both major orders have large trophy size species, a fact related to their migratory behaviour. Indeed, most large fish are potamodromous species that move upstream every year during low water periods (late winter and spring) to spawn during late spring or summer at the rise of the water level. Migratory fish spawn in the water column. They

usually employ reaches with intermediate depth and moderate currents. In the Paraná River, spawning takes place mainly in the Upper reach and in the northern portion of the Middle reach. This behaviour is important when considering decisions concerning season closures. Eggs are semi pelagic and derivate downriver; larvae and juveniles enter the flooded areas where they found refuge and food to growing up, maturing in 2-4 years, to come back to the river main channel for migration and reproduction.

The dominant recreational fishery types of the region are extractive for most species and extractive and catch and release for dorado. However, this latter modality has begun also to be implemented in the latter years in most tournaments.

In the upper section of the Paraná River the presence of the largest specimens of surubí and dorado have given rise to recreational 1, 2 and 3 type fisheries. They are mostly boat fishers (Iwaszkiw, 2001) and in lesser proportion coastline fishers. They may be found in the area between Augusts to May, except during the season closure period in November-December. They use a variety of fishing gears including casting, trolling, spinning and down rigging. Trolling is frequently employed to catch large silurid specimens, mainly surubí. High power outboard boats go upstream, and special artificial baits move up and down within the water column. Depths can reach more that 20 metres in those sectors of the river, and the large silurids are usually found in the deeper channels. Many of them are virtually hooked by the tails, a type of fishing that is banned by present regulations. Every artificial usually bears two triple hooks and it has been suggested by managers to put out the distal one to avoid these unwanted catches. However, this change is hard to introduce in the artificial bait industry.

Living baits are common, giving rise to an occupational activity of locally named "moreneros" because they capture mainly morenas, a common name given to Gymnotiformes (knife fish), particularly of the genus *Gymnotus*, *Brachyhypopomus* and *Eigenmannia*. Other species used as living baits are swamp eel (*Synbrachus marmoratus*), South American lungfish (*Lepidosiren paradoxa*), cascarudos and hoplos (*Calliichthys calliichthys, Hoplosternum littorale and Lepthoplosternum pectorale*), and tararira (*Hoplerythrinus unitaeniatus*). All of them share adaptations to breathe atmospheric air and have high rusticity, standing alive for long periods of time in water containers, even during the hottest summer days. Unfortunately, all these fish are collected from floodplain and marshes and angler demands are continuously growing. There are no regulations or rules for allocation concerning these fishes and particularly in the genus *Gymnotus*, several still unknown species are being used as baits. Fishermen only need annual licenses to carry out this activity, which is mainly for subsistence, since they usually belong to the poorest socio-economic levels.

There are few conflicts within the recreational fishing group in the large rivers of the region. Most problems are related to commercial versus recreational and the international use of waters by Argentina and Paraguay fishers. A new controversy has been growing that confronts catch-and-release and conservationist organizations against extractive anglers.

Out of tournaments, catch-and-release practices are limited to affluents such as Corriente River, placed in the protected area of Iberá Swamps, where only this kind of fishing is allowed for dorado (Bechara *et al.*, 2005). Fisheries types are world-class and recreational 1. The technique employed is mainly fly cast but using large streamers, which occasionally promotes by-catch of piranhas (*Pygocentrus nattereri* and *Serrasalmus spilopleura*) and some other species (*Brycon orbignyanus*, *Hoplias malabaricus*, *Acestrorhynchus pantaneiro* an*Crenicichla vittata*). Some anglers also practice catch-and-release spinning with artificial baits.

To support these fisheries, four lodges placed along the Corrientes river or its source lakes are presently operating. They are located close to the headwaters, where the largest fish concentrations occur. Several outfitters services are also offered. Fish caught are generally smaller than the big trophy size more commonly obtained in the Paraná

River (Bechara *et al.*, 2005). Casting anglers go for a large number of catches (5 to 10 in a fishing day), and at least one of two specimens closer to trophy size (8-10 kilos). However, the number of fish caught is variable and there have been a decrease in the last five years, probably related to the lack of large floods within the system and the increase of extractive fishing.

A decrease in fishing success can eventually result in the closure of those expensive lodges. Fishermen pay several thousands United States dollars a week of fishing including a variety of high-quality level services. They usually fish with the help of local guides using specially prepared boats in pristine and isolated areas, surrounded by a rich and diverse wildlife of aquatic birds, caimans, marsh deer, capybaras and many other wild animals. All these features, plus the famous fighting ability of dorado makes fishing in this area a highly searched experience for casting anglers from all around the world.

An evaluation of the mortality caused by catch-and-release practices, along with an analysis of the practices that reduce injuries are necessary. Although there are no studies on the impact of catch-and-release practices on dorado fish populations, they are supposed to be low, given that this species seems to be very resistant to physical injuries. This species makes large jumps over the water when caught, in an attempt to get out of the hook, a fact that is frequently achieved by the fish. Hooks produce injuries in the mouth and the gills, and large numbers of scales are lost during fights. Moreover, the same specimens can be captured several times in a year or during a fishing season. However, it is expected that mortality related to high and frequent stress will increase as fighting behaviour of dorados is coupled to better-experienced fishermen arriving to the region.

This argument is used by local extractive anglers, who are in conflict with catch-and-release advocates; mainly lodge owners and conservationist organizations that are against extractive fisheries in Iberá marshes. A management plan for the whole wetlands was recently finished and is presently under intense debate among different social statements and interest groups, to be finally established as a provincial law. This plan, in its original form prohibits any type of extractive fishing and limits catch-and-release fishing of dorados. The unsatisfied fishers that support extractive fishing are mostly Recreational 2 and 3 types. They obtained recently a permission from the Corrientes Province government to carry out extractive fishing in a reach of the Iberá Provincial Reserve. However, this allocation is allowed for all the species excepting the most valuable: dorado, surubí and manguruyú.

In the upper portion of the Middle Paraná, recreational 2 and 3 are the most common types of fishing. Most anglers search for fish in motorized high power boats because they have to rapidly find good fishing spots among thousands of islands and channels in the river corridor. Fishing excursions typically last a complete journey from early morning to late afternoon. The fishing guides are usually well informed about sites of school concentration and move dozens and even hundred kilometres a day to find good fishing areas. The economic activity of this kind of fishing is extremely important. Cleminson (2000), estimated for the Santa Fe province a mean daily capture of 5.45 kg/day/fishermen. This activity resulted in about U$ 2 x 10^6 gross annual turnover for the most prosperous years for the six largest fishing shops of the province. To this figure we should also add the economic turnover of small shops, the secondary input from the boat industry, gasoline, hotels, baits, fishing and boat licenses, among many others.

The number of fish every fisher can catch per day is limited according to the species. However, particularly in recreational 3 type, cheating is a frequent practice, especially when large numbers of fish are present. As in any fisheries, fishing success is variable, and the level of exploitation in the Paraguay-Paraná is large enough to provoke a considerably reduction in the unit catch per fishermen. When large schools are found many fishermen take much more than the number allowed per day. This practice

has given rise to a concealed fishing because some anglers may sell their catch in the black market, where in the case of dorados the commerce is banned by law in most provinces.

The general perception of fishers is that number of fish is declining in the river (Cleminson, 2000), and that fishing two decades ago was far more abundant and diverse. Fishers attribute this decrease to commercial fishing, concealed fishing, fishing in the Paraguay, and to the impact of Yacyretá Dam. However, the available statistics from tournaments in the last 10 years reveal that variations in catch may be related to river discharge and hence the amount of water that enters and remains within the floodplain. For example, the number and average weights of dorados remained constant in around 0.11-0.13 kg/hour/angler between 1998 and 2001. In addition, several studies in the Middle and Upper Paraná revealed a significant positive relationship between flood intensity and fish catch with a time lag related to fish size and mean age (Quirós and Cuch, 1989; and Ruiz Díaz, 2004). This fact is rarely taken into account by anglers and even official managers. Others studies have shown that in commercial fishing, large silurid catches in the last 15 years remained fairly constant for the total fishery, although a decrease was observed in fish mean size and average total weight captured per fishermen (Vargas *et al.*, 2004). The total number of fishing licenses increased and the total catch per fisher remained constant probably because artisanal fishers retain species that were formerly discarded. In Yacyretá Reservoir yield-per-recruit assessments showed that *Leporinus obtusidens* present fishing effort is below maximum sustainable yield (Araya *et al.*, 2005). However, there are some evidences that the number per fisher and average sizes of large silurid and pacú decreased in the Middle Paraná River, independently of river discharge fluctuations (Cleminson, 2000; Iwaszkiw, 2001).

The total fish catch for the year 2001 in the Paraná River at Corrientes Province has been estimated from licenses in about 3.000-4.000 tonnes, being half attributed to recreational fisheries, 50 percent of the recreational catches correspond to dorado, 30 percent to surubí and the remaining to the other species (Ovidio Eclesia, pers. comm.). These figures were estimated based on the number of fishing licenses sold, which in that Province, the most important for recreational anglers, amounted in that year near 5 000 a year for local anglers and more that 20 000 a year for tourist anglers.

Along the Paraná River at Corrientes Province, more than 100 lodges, hotels and fisher services are located in the eight more important fisher towns (Iwaszkiw, 2001). Services include experienced fishing guides, boats and bait provision, rooms in hotels and lodges of variable services according to the socioeconomic levels.

In the Yacyretá Reservoir and upstream, deep changes in fisheries occurred after damming. The dam produces a blockage of migrating fish schools coming from more productive areas downriver to spawn. Only a small fraction of these fish are allowed to pass presently by two fish elevators. Capture per unit effort was estimated in the Posadas City area, considering weekend fishing excursions and statistics of seven tournaments (Hirt *et al.*, 2003). They varied between 0.08 and 0.21 kg/hour/fisher, which is a very low value compared with the 0.7 kg/angler/hour that would correspond to Santa Fé Province (Cleminson, 2000, assuming a 8 hours fishing journey) and close to the figures found for dorado fishing tournaments (see below). The most common activity was boat and costal fishing of the type 3. The species more frequently caught were also uncommon for Paraná River recreational fishing due to the scarcity of potamodromous fish, consisting mainly in piranhas (*Serrasalmus* spp.), freshwater rays (*Potamotrygon* spp.) and small Pimelodidae (*Pimelodella* spp.). Other more valued species, such as *Pimelodus maculatus, Leporinus obtusidens, Hemisorubim platyrhynchos, Sorubim lima* and *Zungaro zungaro*, were less common in catches.

Tournaments merit a special paragraph given their popularity and usefulness for fisheries' evaluation. Many type 2 and 3 recreational fishers desire to win one of those

tournaments and they always participate in large numbers. Anglers competing in the famous dorado fishing tournament in Paso de la Patria reached a maximum of 582 fishers and 194 boats in 2004, while 1454 fishers and 497 boats participated in the surubí tournament in Goya (both localities in Corrientes Province) (Iwaszkiw 2001). Those tournaments have been major social, cultural and economical events for the riverine towns for more that 40 years. They are an important part of the tourist attractions of the region, assembling thousands of people during two to three days. Dozens of killed fish remained displayed in the "gancheras" after a fishing session being part of the show in these tournaments. However, as explained earlier, in the last three years there has been a decrease in the number of fish caught in the Middle Paraná River. This fact forced organizers to change from extractive to catch-and-release modes, a fact that allowed increasing the number of specimens to be caught because size is no longer a limitation. Now, the exhibition of killed fish is replaced by large screens showing to the public scenes of fishing and the prized fish registered by official video cameras during the day. With this new type of fishing, the number of dorados and surubí caught per angler during tournaments doubled or tripled, although the lower size range decreased in about 20 to 30 cm.

As explained earlier recreational fishing in Argentina is regulated by the provinces, except in National Parks. Giving that most rivers share provincial and international jurisdictions, this political scheme generates frequent problems and conflicts concerning different uncoupling among provinces. Fortunately, during the last ten years, an international joint commission between Paraguay and four limiting provinces of Argentina has been consolidated. The countries signed an agreement and formed a coordinating committee for conservation and development of fisheries resources in the border reaches of the Paraguay and Paraná River. In order to establish regulations, the commission relies on consultation with an Advisory Committee formed by different interest groups related to the resource (e.g. scientists, technicians, commercial and recreational fishing organizations, outfitters and lodge owners and administrators, coast guard, etc.). The code establishes target species that may be captured in common waters; species specific daily catch quotas per fisher, fish size limit regulations for the most important species, season closure periods, types of gears and fishing practices banned, reserves and protected areas, and other general policies. These regulations apply to most waters of the large rivers of the region including interprovincial waters. For example, season closure, which usually takes place between November 1 and December 20 every year, is generally applied in the overall extent of the four northern provinces and Paraguay.

This code was achieved by consensus among the parts, taking into account previous management schemes, but without major revisions of the objectives and usefulness of the rules to be applied. As in other waters of Argentina, very little is still known about the processes that should direct sound management schemes. Real managers in most provinces are lacking (Cleminson, 2000) or in the best cases they cannot act as expected, because of the very few resources available, and the limited capacity for taking decisions. They usually work hard to solve critical or conflictive points that threaten political or social stability, remaining the rest of the time limited to bureaucratic tasks and trying to keep track of the fisheries without adequate budgets to consider any major management plan. Socials claims in Argentina have increased since year 2000, and artisan fishers do not hesitate to threat cutting the Paraná River commercial navigation with its boats or to stop the traffic for several days in critical bridges over the river if their claims are not listen by the government.

There are not catch quotas for any of the fishing types allowed. Therefore, the total fish catch in the region is open since the number of licenses sold is not limited and increases every year (Iwaszkiw, 2001) and the number of fish allowed per angler remains constant in time. Therefore, the only limitation to over fishing is the allowed

fish minimum size, provided all anglers respect that size. Those sizes were fixed 30 years ago following approximate rules and kept with minor changes. Fortunately, most of them are no so far from critical sizes, according to the criteria of Froese and Binohlan (2000) (Table 2) and all figures are above mean size at first maturation. Presently, all those sizes are under revision by the advisory committee of the international joint commission of Paraguay and Argentina, and they possibly will be adjusted to closely follow actual critical size minus 10%. However, this kind of management presents several drawbacks. First, the lack of enough number of large specimens to fulfil some angler expectations will deter the highest levels of recreational anglers, and recreational 2 and 3 type anglers will be forced to target fish of the less valuable species. However, fish minimum size varies according to species, and fishing gears employed for some small species may force the by catch of larger species below the allowed size. In some cases the fish can be released, but in others such as in the corvina (*Plagioscion ternetzi*) they generally die after being captured. Second, there are no allocations, so the fisher group with the most effective fishing technique will take a larger portion of the available fish, which is an unfair situation that can promote conflicts. Recently, provinces along with national officials have been trying, to convince commercial and artisan fishermen to limit the number of licenses, which seems to be hardly accepted by northern artisan fisher associations. The main reason of these new policy was the industrial fishing implanted in the lower portion of the Paraná River (Iwaszkiw, 2001), which is supposed to catch more than 50 000 tonnes a year of sábalo (*Prochilodus lineatus*) only for exportation. In the future, those limitations would extend to recreational anglers so as to establish quotas, which should be equitable and reached by consensus.

In Corrientes Province, the type of fishing (commercial vs. recreational, catch and release vs. extractive) is usually allocated by areas. Only a restricted section of the river is allocated for commercial fishing, while the whole river is open to recreational fisheries. In natural reserves, catch-and-release is the only allowed form of fishing. However, these rules are widely violated because artisan fisheries are established in areas where they are not supposed to be permitted. In other provinces of the Northeastern region, different kinds of fisheries share the same area. Those allocation schemes do not respond to an integral management perspective taking into account biological productivity of a given fishery, the mandates of different institutions and/or the requirements of fishers harvesting the resource. As in others rivers of Argentina, the lack of comprehensive management based on solid research programs and monitoring, generate conflicts such as when world-class fishing lodges oppose extractive fishing by local inhabitants (e.g. Corriente River). However the large spatial and temporal complexity of river systems makes this task a real challenge, and requires of flexible management plans that should be sensitive to many different types of needs with awareness of seasonal variability (Cleminson, 2000).

There are very few fish controls along the rivers, which opens the door to frequent rule violations. The most serious acceptance to the rules occurs during season closures, when controls are stricter and more frequent, and for which a general consensus among fishers exists about the importance and effectiveness of this management rule. However, from a strictly scientific point of view, there is no evidence of its effectiveness regarding species, time of the year and length. However, this practice is so popular and widely accepted, that it is worth to preserve as a management tool.

There is still a lot of work to be done in this region of Argentina to achieve an equitable sharing of the rich fish resources. Provinces and National government still invest very little in research for improving management, or in monitoring the actual impact of implanted regulations.

The lack of funded research programs reflects also the slight interest that official managers put on knowledge to improve management policies, which is part of the general cultural backwardness of the region. This is somewhat contradictory because

recreational fisheries are extremely important for local economies and many small towns along the river for which recreational fisheries and tourism are the main income source. Only fishing tournaments are carefully evaluated because of the need of correctly giving the prize to the winners. The selling of licenses generates large revenues in some provinces, but they are not adequately employed to improve the present state of the fishery. It is expected that in a near future, authorities will finally understand the importance of scientific information, monitoring and adequate controls, and will establish sound policies of integral and equitable management in agreement with all parts ensuring the sustainability of this valuable resource.

3. CENTRAL, WESTERN AND NORTHWESTERN REGIONS

The Central, Western and Northwestern regions of Argentina (Figure 3) have the most massive recreational fisheries in natural and artificial lakes. These fisheries are principally directed to the relatively wealthy Argentinean middle class. However, the socio-economic information necessary to manage those fisheries is scattered in many provincial jurisdictions or it is directly lacking. The emphasis in fisheries regulation is usually stressed on closed seasons and bag limits but fishery regulations fluctuate widely among jurisdictions. In lakes and reservoirs, stocking of larval fish is the favourite tool for fisheries managers mainly due to the lack of monetary and technical resources. The lack of studies or any other information about stocking results and efficiency is a general pattern.

For these regions, fish is a public common resource as well as for most of the Argentinean freshwaters but fisheries law enforcement and control is weak for most of the sites. Responsibility for regulating fisheries in public waters rests with provincial fisheries agencies. However, the disperse attempts to manage and control exploitation are generally insufficient and largely political. Fishery regulations have been issued generally in response to the declining fisheries and the desire to protect stocked fishes. Most laws regulate either the seasons or methods of recreational fishing. Closed seasons are implemented to protect spawning fish, under the implicit belief that spawners are needed to assure future catches. Such regulations interspersed with ambiguities and contradictions are usually ineffective for fish conservation,. The few regulations that do exist for sport fishing are even less likely to be enforced due to lack of coherent policies, and few fishery officials aided by ordinary police. Moreover, valuable data to fisheries managers like total catch and effort data are usually not sought for or reported.

The management of freshwater lake recreational fisheries is not an important issue for provincial and local government levels in Central and Northern Argentina. The participation of the public in the management decision-making process is practically null. The last country wide national intent in order to get basic lake and reservoir limnological and fish information crashed more than 20 years ago (Quiros, 1990). Fisheries science is at present dispersed in a few universities where poorly financed small research groups struggle to get some narrow local results.

In the central regions of the Pampas plains, both recreational and commercial fisheries are common. The pampean lakes contain a relatively diverse temperate fish community (López *et al.*, 1996); more than 60 fish species have been identified in these lakes (López *et al.* 2001). The "pejerrey" (*Odontesthes bonariensis*), a visual planktivore atherinid, and the "tararira" (*Hoplias malabaricus*), an ambush top predator, are usually the fish species preferred by both recreational and commercial fishers. A particular feature for the larger very shallow lakes at the Pampas is the existence of an important poaching activity for these fish species, which generates frequent conflicts with recreational fishers.

Recreational pampean fisheries are based mainly on "pejerrey", a fish highly valued mainly due to its size and flesh flavour attributes. According with our classification, the prevalent recreational fisheries types are 2 and 3 (Table 1) for this region. The remnant

shallow "clear" lakes are preferred fishery sites to catch few bigger big fish (Quiros *et al.* 2002). However, the large saline lakes are the preferred sites to fish more and larger "pejerrey" fish when diluted during heavy rainy years.

Recreational fishing is an important leisure activity for the habitants of the Pampa's plains. There are more than 450 sport angler clubs in Buenos Aires metropolitan area (López *et al.*, 1996). Fishing tournaments are common for this region. The angler mean displacement for a fishing trip ranges between 150 and more than 500 km. The fishing gears used in the shallow lake recreational and sport fisheries to catch the pelagic "pejerrey" are exclusively monofilament nylon with floats and hook and bait. Rods and lines are operated from the lake shoreline, small boats or wading in shallow lakes. Hook and line gear is usually used to catch the predator "tararira" in the recreational fishery. However, flies and lures are also commonly employed to catch this last fish.

There is a general perception that recreational fisheries for "pejerrey" has deteriorated during the last 20 to 30 years, mainly due to habitat alteration by unregulated agriculture and urbanization development. The pristine lakes were "clear" and macrophyte dominated but lake eutrophication conducted to predominant "turbid" green lakes (Quirós *et al.*, 2002). Recreational anglers are concerned that most of the lakes have not sustained populations of "pejerrey" with large fish. Moreover, for lakes heavily loaded with urban sewage discharges "pejerrey" is usually displaced by a pelagic filter feeding planktivorous fish ("bagarito", Parapimelodus valenciennesi).

The numerous natural lakes in the Pampas and the lack of appropriate management and timely fishery information makes it difficult to predict the sport fishery. The "pejerrey" populations of a very few lakes have been studied more intensively (Freyre, 1976; Rosso, unpublished data) but the general pattern is a lack of results from particular lake population studies. This insufficiency of fishery studies outcome makes fishery management for individual lakes still more difficult. Minimum size limits for "pejerrey" were recommended in lakes where the quality of the fishery needed to be improved, or for very productive lakes where fishing pressure is intensive. Slot limits have been also recommended in order to provide protection for a diversity of fish sizes (Baigún and Anderson, 1993). Although fish in pampean lakes have been exploited by commercial fisheries for many years, fishery management objectives are mostly directed to recreational fisheries by provincial law today (Table 1). Very few studies have been implemented in order to estimate angler preferences and exploitation rates (Baigun and Delfino, 2003). The highly variable ecological characteristics of the landscape are reflected in lake functioning, and hydrological variability among years is clearly reflected in lake fish population abundance. This fate limits seriously the value of results obtained from the application of angling surveys to individual lakes on a time discontinuous basis.

In the Western and Northwestern arid and semi-arid regions of Argentina (Figure 3), recreational fisheries are mainly developed in small to middle-sized reservoirs (5 to100 km^2). Riverine fisheries are only important in the northern part of the region, at the tributaries of the large rivers. The main land use in these regions is for agriculture and most of the reservoirs are eutrophic or hypertrophic (Quiros, 1990). Although fishing was generally a secondary objective for most reservoirs constructed in arid and semi-arid regions, they are intensively used for recreational fisheries today. The fish resource is middle to highly exploited by man but environmental degradation due to agriculture and urbanization is an actual threat for it (Quiros, 1990). There are not commercial fisheries in reservoirs but subsistence fisheries based in common carp are relatively important in some more densely populated poor regions. Also an increase of water reservoirs for aquaculture purposes is planned. Recreational fisheries in reservoirs are based mainly in introduced game fish as the pampean silverside "pejerrey", the predator "tararira" and the common carp. Recreational fishermen do not depend on the fishery for employment, treating fishing more as a temporary pastime. They are

often a relatively middle class wealthy group frequently with some urban professional backgrounds (Volante *et al.*, 1997). They are, therefore, external to the rural milieu in which they find their sport. For these regions, recreational fisheries are, according with our classification, type 3 (Table 1); large fish are not usually common in Western and Northwestern Argentinean reservoirs.

4. PATAGONIA AND TIERRA DEL FUEGO FISHERIES

Patagonia and Tierra del Fuego recreational fisheries are centred on cold-water species, mainly salmonids that in some cases meet world-class standards (Leitch, 1991; Vigliano and Alonso, in press). As a consequence during the past twenty years the region has seen a rapid development of highly priced recreational fishing and the establishment of international quality fishing lodges and outfitters. This in turn has brought to the attention of local governments the potential economic turnover of recreational fishing and in some cases conflicts with local, regional and national fishers. Demands for management have sparked a growing trend on recreational fisheries oriented research (Vigliano and Alonso, 2000; Pascual *et al.*, 2001; Pascual *et al.*, 2002; Riva Rossi, 2003; Ciancio *et al.*, 2005; Macchi *et al.*, in press; Pascual *et al.*, in press).

Argentine Patagonia and Tierra del Fuego (Figures 1 and 4) compromise the Neuquén, Río Negro, Chubut, Santa Cruz and Tierra del Fuego provinces covering over 1 7million km^2, from the Andes on the west to the Atlantic Ocean in the east. The region is characterized by a harsh cold climate and low population densities (1.2 inhabitants/km^2). Most of Patagonia and Tierra del Fuego show a marked climatic gradient from west to east brought about by the Andes acting as an effective barrier against the moist westerly winds which causes humidity to drop rapidly defining two distinct sectors. The Andean sector in the West is characterized by a temperate forest landscape presenting countless ultra-oligotrophic and oligotrophic lakes and streams (Calcagno *et al.*, 1995; Modenutti *et al.*, 1998a, 1998b). The Patagonian steppe sector east of the Andes is an arid landscape that extends to the Atlantic Ocean. Major watersheds (Figure 4), fed mostly by thawing winter snows and spring and autumn rainfall are born in the Andes. Six of these drainage cross the Andean range draining into the Pacific Ocean. The remaining drainage's flow East through the Patagonian steppe draining into the Atlantic Ocean being their lower reaches under tidal influence. Some of these drainages like the Rio Negro basin in northern Patagonia

FIGURE 3

Hydrology of the Central, Western and Northwestern regions: 1 Río De La Plata, 2. Paraná river, 3. Salado river (Buenos Aires province), 4. San Borombon river, 5. Canal 5 river, 6. Mar Chiquita, 7. Colorado River, 8. Slado river (La Pampa province), 9. La Amarga lake, 10. Atuel river, 11. Diamante river, 12. Tunuyan river, 13. San Juan river, 14. Jachal river, 15. Quinto river, 16. Cuarto river, 17. Tercero river, 18. Segundo river, 19. Primero river, 20. Mar Chiquita lake, 21. Dulce river, 22 Salado river. (Modified from USGS Global GIS Data Base. Digital Atlas of Central and South America)

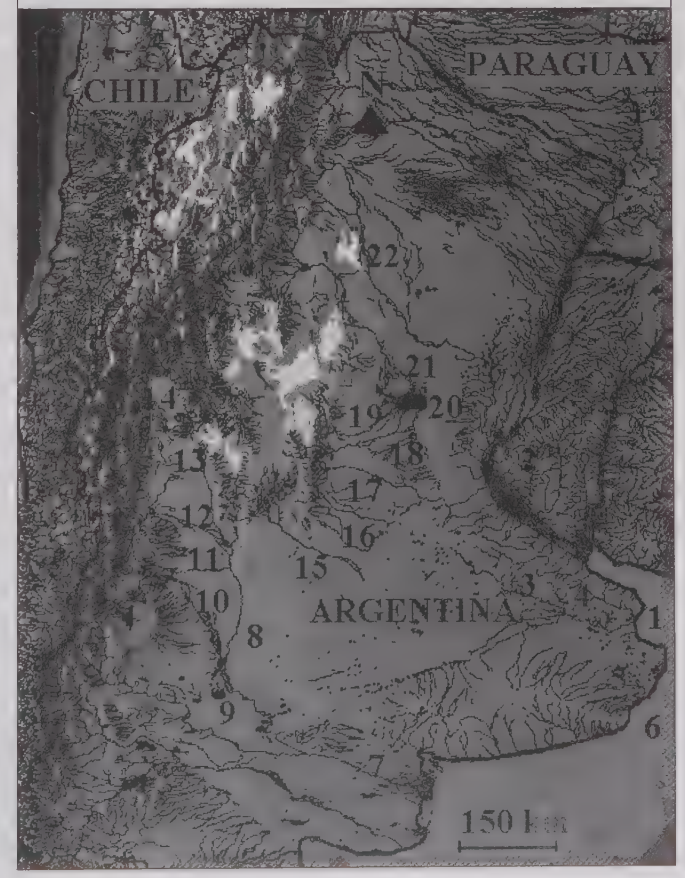
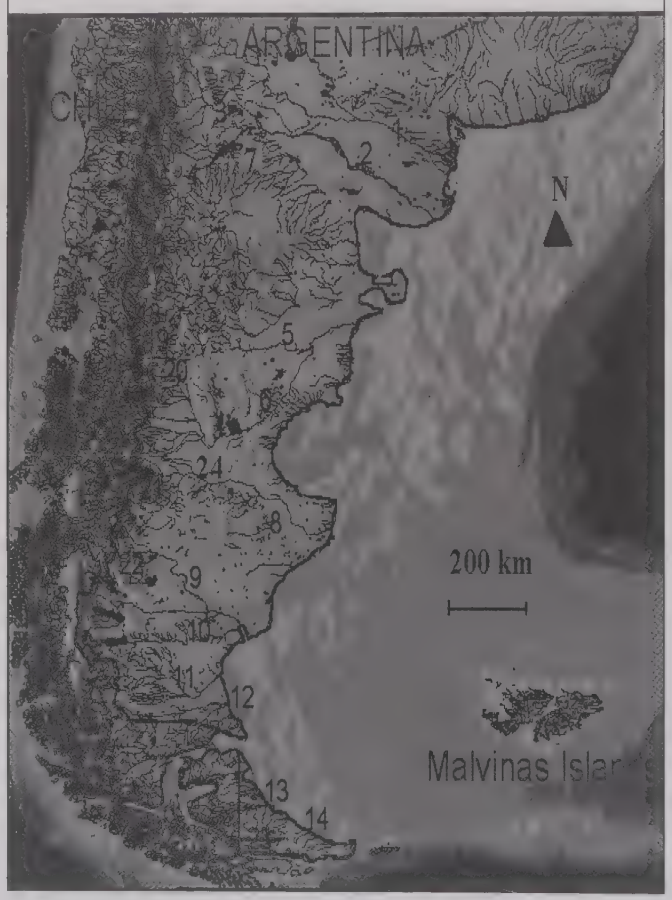


FIGURE 4
Hydrology of Patagonia and Tierra del Fuego regions. Atlantic drainages: 1. Colorado river, 2. Negro river, 3. Neuquén river, 4. Limay river, 5. Chubut river, 6 Chico river (Chubut province), 7. Senguerr river, Deseado river, 9.Chico river (Santa Cruz province), 10. Santa Cruz river, 11. Coig river, 12. Gallegos river, 13. Grande river, 14. Ewan river, Pacific draining: 15. Lacar lake, 16. Manso river, 17 Puelo lake, 18. Futaleufu river, 19. Corcovado river, 20. Pico. lake, 21. Pueyrredon lake, 22. San Martín lake, 23. Fagnano lake, Endorheic basin 24. Senguerr river. Modified from USGS Global GIS Data Base. Digital Atlas of Central and South America)



have undergone huge changes due to the construction of hydroelectric dams along the Neuquén and Negro rivers. Others such as the Santa Cruz drainage in southern Patagonia are being considered for hydroelectric development.

Within National Parks jurisdiction conservation of native fish species is a main priority, to the point that all native species caught within National Parks must be immediately released. On the other hand no further than 10 years ago, salmonids were unofficially seen as a nuisance that did not deserve to be studied or taken into account. Today, sport fishing for salmonids is seen as an important recreational activity, but the processes that govern native – exotic interactions and thus structure fish communities are at best poorly understood (Pascual *et al.*, 2002). Within this context possible outcomes upon fish communities brought about by fishing regulations such as mandatory release of all native fish and the kill quotas established for salmonids are anybody's guess.

Argentine Patagonia and Tierra del Fuego have a low fish diversity consisting of 36 fish species of which 16 species are targeted by recreational fishers (Table 3). Salmonids are not only the most important group of introduced exotics but also the generally preferred targets (Pascual *et al.*, 2002; Vigliano and Darrigran, 2002). Introductions started in the early 1900´s, (Tulian, 1908; Marini, 1936), shifting stocking policies trough out time (Macchi, 2004; Macchi *et al.*, in press) eventually gave rise to feral populations of rainbow trout (*Oncorhynchus mykiss*), chinnok salmon (*O. tshawytscha*), brook trout (*Salvelinus fontinalis*), lake trout (*S.namaycush*), brown trout (Salmo trutta) and landlocked Atlantic salmon (*S. salar*) (Pascual *et al.* in press). Of these species rainbow trout brown trout and brook trout became widely distributed and the basis for an extensive salmonid catch and release and extractive recreational fisheries through out the region. Also in some locations, like the Traful, Curruhue grande and Cholila lakes the Atlantic salmon managed to adapt becoming landlocked and giving rise to particular fisheries.

Native fish (Table 3) such as perch (four species), the pejerrey (two species), the common carp and some of marine origin such as the liza, robalo and flounders that swim into river mouths and tidal influence sectors are also sought for.

TABLE 3
List of the most important recreational target species in Patagonia and Tierra del Fuego

Order	Scientific name*	Spanish common name	Habits
Salmoniformes	*Oncorhynchs mykiss*	Trucha arco iris	freshwater and andromous/ top predator (fish and macrozoobenthos)
	Salmo trutta	trucha marron	freshwater and andromous/ top predator (fish and macrozoobenthos)
	Salmo salar	Salmon encerrado	landlocked/top predator (fish)
	O. tshawytscha	Chinook salmon	andromous/top predator
	Salvelinus fontinalis	Trucha de arroyo	freshwater/top predator
	S. namaycush	Trucha de lago	freshwater/top predator
Atheriniformes	*Odontesthes hatcheri*	Pejerrey	freshwater/benthic and planktonic feeder
	O. bonaeriensis	Pejerrey	freshwater/benthic and planktonic feeder
Perciformes	*Percichthys altispinis*	Perca	freshwater/fish and macrozoobenthos
	P. colhuapensis	Perca	freshwater/fish and macrozoobenthos
	P. trucha	Perca	freshwater/fish and macrozoobenthos
	P. vinciguerrae	Perca	freshwater/fish and macrozoobenthos
	Eleginops maclovinus	Robalo	marine – brackish water/
	Mugil liza	Liza	`marine brackish water/
Cypriniformes	*Cyprinus carpio*	Carpa	Freshwater/omnivorous
Pleuronectiformes	*Paralichthys sp.*	Lenguado	Marine- brackish water/top predator

* Scientific names according to Fish Base.

Biogeography, histories of introductions, environmental and socio.-economic characteristics have determined the existence of distinctive fisheries in this region. As stated by Pascual *et al.* (in press), towards the west in the slopes of the Andean range unregulated streams and rivers and glacially originated lakes introductions of salmonids gave rise to feral populations and world class, recreational 1, 2 and 3 type fisheries (Table 1). Thus diverse groups of resource users which in general terms are shore and boat fishers (Vigliano and Lipppolt, 1991; Vigliano and Grosman, 1997) may be found in the area during the November to April fishing season using a variety of fishing gears and tackle (e.g. fly fishing, spinning, casting trolling, down rigging). The different human groups involved (e.g. strictly catch and release fishers, highly extractive ones, family recreational fishers, lodge owners and outfitters) do not share precisely the same goals and expectations with regards to fishing trip outcomes (Vigliano *et al.*, 2000). This has brought about conflicts between fishers groups and their perceived right to access waters, catch and dispose of fish.

Today, salmonid sport fishing is seen as an important recreational activity, but the processes that govern native – exotic interactions and thus structure fish communities are at best poorly understood (Pascual *et al.*, 2002). Within this context possible outcomes upon fish communities brought about by fishing regulations such as mandatory release of all native fish and the kill quotas established for salmonids are anybodies guess.

In northern Patagonia, rivers (e.g. Río Negro and Colorado rivers) that traverse the steppe and drain into the Atlantic ocean sustain type 2 and 3 recreational fisheries of mostly native species, which include two silversides (*Odontesthes hatcheri, O. bonariensis*), four species of Percichthyds, (*Percichthys altispinis, P.colhuapiensis, P. trucha and P. vinciguerrae*) and three species of marine origin that swim up river: a mullet (*Mugil liza*), a flounder (*Paralichthys sp.*) and the patagonian blennie (*Eleginops maclovinus*). This fishery is predominantly extractive, live bait is commonly used

and the fisher's goal generally is to maximize catch and retention of fish which are consumed.

Some southern Patagonia and Tierra del Fuego rivers draining into the Atlantic and Pacific oceans sustain runs of anadromous salmonids which gave rise to world class and recreational types 1, 2 and 3 fisheries. The Santa Cruz River in the namesake province holds an anadromous rainbow trout population that, according to genetic analysis, developed from fish originally introduced from populations of the McCloud River in California (Pascual *et al.*, 2001; Riva Rossi, 2003). This has led in the past ten years to the development of an on growing recreational fishery centred on the Santa Cruz "steelhead trout", which is rapidly becoming a local generator of economic turnover. Two types of fishers use the resource, local ones and people from other areas attracted by the possibility of catching steel head trout. Meanwhile the first group is mostly extractive, the second one is a mixture of catch and release fishers. An initial outfitter business is starting to develop, but formal international level fishing lodges have not established yet. Also, the establishment of a Chinook anadromous salmon population on the headwaters of the Santa Cruz drainage system has recently been confirmed (Ciancio *et al.*, 2005), being this the first citation for an Atlantic draining system in South America. According to the same authors these fish may have originated from escapes from ranching experiments in the 1980s or from introductions conducted almost a century ago. Whether this will lead to a recreational fishery of economic importance remains to be seen.

Also draining towards the Atlantic: the Gallegos in Santa Cruz province and the Menendez, Grande and Ewan in Tierra del Fuego rivers, have runs of anadromous brown trout, which are sought for by world class and recreational types 1, 2 and 3 fishers. In the first three rivers; caught specimens normally weight more than 5 kg. All three rivers have well-developed and established fishing lodges which restrict access to local and regional fishers. A good example of the importance of these developing fisheries in terms of local and regional economic turnover is the one supported by the world class Río Grande fishery in Tierra del Fuego. Twenty years ago only one fishing lodge existed which recorded a couple hundred caught and released fish averaging 5.5 kg. By 1997 this same lodge recorded releasing more than 4 000 fish of approximately the same size, some weighting up to 12 kg and with records of up to 16 kg. The river now holds 5 fishing lodges with strict catch and release policies giving complete service to an international clientele that may pay between 3 000 and 6 000 United States dollars per week (Vigliano and Alonso, in press). The river is also fished by people from the local city of "Río Grande" (40 000 inhabitants), which are mainly extractive and resent that access to most of the 150 km river has been restricted by lodges. The huge benefits for lodge owners makes them adamant to a less restrictive policy and suspicious of any approach to scientifically manage the resource. The huge success of the lodges has prompted other landowners to close access to the rivers that run through their properties and to request licenses in order to start their own lodges thus creating more conflict. The provincial government does not have a comprehensive policy or strategy to deal with these conflicts.

Because some of the drainages that originate in the Eastern side of the Andean range head west and drain into the Pacific Ocean (Figure 4) these systems are subject to colonization by salmonid species that escape from Chilean aquaculture facilities. Thus the Pacific drainages of the Futaleufu and Corcovado river basins in Chubut Province, have runs of Chinook salmon, that were first reported as spawning in 1991 (Grosman, 1991; Pascual *et al.*, 2002). The appearance of this species has caused mixed feelings, while fishers are exited about the possibility some fishing guides and outfitters worry that it may produce a change in the system that could bring harm to the already successful recreational type 1 and 2 fisheries of rainbow trout and brown trout in the area.

Also reports of Atlantic salmon apparently appearing in other Pacific draining systems such as the Puelo basin in both Chubut and Río Negro provinces are starting to be common and even if they require confirmation, it may indicate future changes to come to the existing fisheries in those drainages.

Recreational fishing in Patagonia and Tierra del Fuego has been regulated for the past 10 years by a common fishing code developed and actualized every year by a Consultive Commission on Patagonia Continental Fishing, which brings together Provincial governments and the National Park Administration. In order to establish regulations the commission relies on consultation with different interest groups related to the resource (e.g. technicians, fishing organizations, outfitters and lodge owners and administrators, fishing guides, etc.). The code establishes target species that may be sought for in each water body and jurisdiction; species specific daily catch quotas per fisher, special fish size limit regulations, fishing seasons, types of gears allowed and other general policies. For most cases these regulations are not based on formal fishery studies but rather on perceived resource status and trends. Thus, for most, environments regulations are set according to specific mandates of particular agencies such as the total protection of native species within National Park jurisdictions mentioned earlier, specific provincial policies or interest, or those of joint comities of shared basins between Chile and Argentina with little data on the resources involved to support them. While there has been a considerable increase on biological and biogeographical data on the past ten to fifteen years, what is known about the processes that could direct sound management programs it still very little. As stated by Pascual *et al.* (in press) research usually responds to concern of specific interest groups in relation to specific issues or fisheries, "but without the umbrella of an integral view of freshwater management".

Within this context allocation in Patagonia and Tierra del Fuego as a policy is established in terms of catch quotas such as number of fish of a given species that may be retained by any fisher on a daily basis, varying according to water body jurisdictions and related interest groups. This allocation scheme usually does not respond to an integral management perspective taking into account biological capacities of a given fishery, the mandates of different institutions and/or the requirements of fishers harvesting the resource. Instead allocations as explained rely mainly on the particular perception of specific sectors and interest groups. The lack of comprehensive management based on sound research and more akin to interest groups has in many situations generated conflicts such as where world-class fishing lodges interest have restricted access to historical fishing grounds (e.g. rivers Grande, Menendez and Ewan in Tierra del Fuego, Gallegos in Santa Cruz province, Traful in Neuquén province etc.) to local and regional residents.

Shared jurisdiction is a common trait of Argentine Patagonia and Tierra del Fuego waters leading in many cases to contradicting regulations. Such is the case of Laguna Blanca, a Ramsar site mostly under National Parks administration but with a small portion under Neuquén province jurisdiction, meanwhile the former allows fishing the latter one prohibits it in its sector.

To ensure an equitable and sustainable use of the recreational fisheries of Patagonia and Tierra del Fuego more fishery oriented studies that take into account not only the environmental and biological constrains of the involved resources, but also the intricacies of the human factors associated to them are needed. For this the human resource base dedicated to the problem as well as the funding for infrastructure and research will have to be expanded. Today only four research groups related to the fish resources of Patagonia and Tierra del Fuego are radicated within the region. Lack of comprehension of the inherent complexities and economic potential of recreational fisheries is hardly understood by politicians. Funding for research is usually scarce and oriented towards particular problems and not to understanding the processes that lead to those problems.

Comprehensive views for each fishery are lacking and will have to be developed in a dynamic way in order to produce management schemes that correspond to reality and offer chances of maintaining the recreational fisheries trough out time.

5. FINAL REMARKS

As mentioned before, a wide body of laws and regulations exists in relation to conservation and management of natural resources. However, despite the existing jurisprudence, there seems to be a mismatch between the purpose of the law and actual management. This mismatch seems to stem from the lack of awareness of politicians and other stakeholders regarding the complexities of managing dynamic systems such as fisheries. This in term implies lack of integrated approaches towards the sustainability of Argentina's inland recreational fisheries.

Through out the present paper we have shown that allocations for most situations in inland Argentine fishing are not set by information resulting from management oriented research. That is to say, in most cases allocations are not driven by careful analysis of environmental, biological and human factors, but rather by decisions based on particular agendas or perceptions of particular interest groups. We have also to consider that particular allocation strategies are not usually monitored through out time, resulting on "guesstimates" of their outcomes, which some times are in term used as criteria to determine new allocations policies. This course of action tends to generate conflicts within and between sectors and no guarantees with regards to resource integrity and sustainability.

It thus seems obvious that a common series of priority gaps must be resolved in all three regions in order to ensure the sustainability of Argentina's inland recreational fisheries. These should include: (1) creating awareness about the dynamic complexities inherent to fisheries and therefore of the need of management-oriented research; (2) develop local and regional research programs that could generate environmental, biological and the human factor information that may lead to sound management decisions and allocation policies; and (3) to integrate all stakeholders of particular fisheries into the decision process.

6. ACKNOWLEDGEMENTS

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Commercial allocation issues

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ABSTRACT

It is now widely recognized that property rights are conducive to economic efficiency in fisheries and, moreover, the higher the quality of property rights the more efficient the associated economic activity. Economic efficiency in fisheries generally implies a high degree of sustainability in the sense that the risk of a stock collapse is small. Note, however, that maximizing the efficiency of commercial fisheries may involve the decimation of non-commercial stocks or stocks of little commercial value. This may or may not be socially optimal.

Property rights suggest the need for (an initial) allocation of these rights. In this paper it is shown that if either the markets are not perfect or the property rights not perfectly tradable, the allocation of rights can make a difference for the outcome in terms of efficiency and sustainability. So, at least in these terms, allocation matters. This suggests two questions: How much does allocation matter and what would constitute a good allocation? The paper considers these questions and attempts to provide partial answers. The paper goes on to examine the income distributional implications of the allocation of fishing rights. It is shown that contrary to common beliefs, it is not generally true that the initial recipients of fishing rights receive all or even most of the benefits associated with using these rights. It is shown, moreover that attempts to effect a more equitable distribution of income by imposing constraints on the trade in fishing rights may easily be counterproductive.

1 INTRODUCTION

The purpose of commercial fisheries as that of any other economic activity is to contribute to human well-being. To maximize this contribution, commercial fisheries must be as economically efficient as possible. Efficiency is synonymous with the maximum flow of economic benefits over time. Due to the nature of fish renewal processes, this generally implies fairly large stocks of the valuable species.[226] Thus, economic efficiency in fisheries generally implies a high degree of sustainability in the sense that the risk of a stock collapse is small. Note, however, that maximizing

[226] There have several theoretical studies of optimal extinction of animal species (see e.g. Clark). From this literature and other more advanced considerations (e.g. the option value of keeping a species alive), it appears that for valuable species, extinction can only be optimal when either the stock is so small that it is not worth preserving, or the rate of discount is so high that the future is worth very little. The first situation happens only by accident - it basically violates the fundamental optimality of sustainability. The second situation is where society has no interest in the future in which case extinction, and, in fact, general liquidation of assets would be optimal.

the efficiency of commercial fisheries may involve the destruction of non-commercial stocks or stocks of little commercial value. This, depending on circumstances, may or may not be socially optimal.

It has been known for a long time that high quality property rights promote economic efficiency (Smith, 1776, Furubotn and Richter, 2005). Later research indicates that high quality property rights may be sufficient for efficiency and economic growth (Demsetz, 1967, Arnason, 2006a). Fisheries are no exception to that rule. It has been found both theoretically and empirically that property rights are conducive to economic efficiency in fisheries and that the higher the quality of fishery property rights the more efficient the fishery operations (Arnason, 2006a). Moreover, it has also been found, that attempts at fisheries management that are not based on private property rights are generally failures, often abject ones (OECD, 1997). It follows that if we want efficiency in fisheries, we must look to property rights-based regimes.

Property rights do not exist in nature. They are a human creation, a social institution. To apply this social institution, that is to say create property rights, requires the (initial) allocation of these rights. This, obviously, raises the question of how. Clearly, the allocation of property rights has implications for the distribution of wealth and income. Whether it also has implications for economic efficiency and, in the case of natural resources, sustainability, is much less clear.

In this paper we explore the implications of allocation of fisheries rights to commercial fishermen. First and foremost we will be interested in the effects of allocation on economic efficiency. The basic result is that if markets are perfect and trading costless, the allocation of fisheries property rights has no impact on the economic efficiency of the fishing activity. So, in that special case allocation doesn't matter. If, on the other hand, markets are not perfect or the property rights not perfectly tradable, the allocation of rights will generally make a difference for the outcome in terms of efficiency and sustainability. Therefore, under these circumstances, allocation matters. We will also look briefly on the distributional implications of the allocation of fisheries property rights. The general assertion here, much trumpeted about, is that the initial recipients of the property will receive all the benefits it can offer. It is shown that as a general theorem, this is not true, although as an empirical matter, the initial recipients may well receive the bulk of the benefits.

The paper is organized formally as follows. In the next section we will talk about allocation of fisheries rights and the resulting efficiency of the fishery. In the following section we will consider allocation and distribution. Finally, in the last section of the paper we will attempt to draw practical conclusions from our investigation.

2. ALLOCATION AND EFFICIENCY

To rigorously study the impact of allocation of property rights in the full dynamic setting of the fishery is a complicated undertaking. Fortunately, it so happens that the key results of the theory can be deduced and explained in a reasonably simple manner and without having to resort to any higher level mathematics.

Consider a fishery subject to some overall rights to be allocated to individual fishers or fishing firms. These rights can theoretically be any fishing rights defined by the fisheries authorities including fishing licenses, allowable fishing days, catch quotas, rights to apply certain fishing gear or certain areas and so on. However it is probably easiest to think of them as just harvesting rights. In that case the overall rights would be the total TAC and the allocated rights individual harvesting quotas or quota shares. For simplicity, we assume that the rights, whatever they are, can be allocated in any quantity to any number of potential receivers.

In most fisheries, the number of potential receivers of fishing rights is very high. To derive our basic results in an easy manner, it is sufficient, however, to consider just two potential receivers. The reason is that the allocation to any number can be analysed

as first an allocation between one individual and all the rest, and then the allocation between the first individual in the rest and the then remaining group and so on.

The fishers or fishing firms in question may derive some benefits from using the rights they receive. If they derive no benefits from the right, the right is worthless and there is no problem of allocation.[227] These benefits would often be profits but could be anything of value to the fishers. In what follows, we will measure these benefits, irrespective of their nature, in monetary units. It is important to realize that this is totally unrestrictive.[228]

Formally express the benefits to the fishers as the benefit functions:

(1) B(q(i);i), i=1,2,

where q(i) denotes the quantity of the right allocated to fisher i. As already mentioned, we only consider two fishers, fisher 1 and fisher 2. The two benefit functions will generally be different, hence the index i in the functions, but could be the same. We take it that for both functions, the benefits increase in the quantity of rights received, at least up to a point.

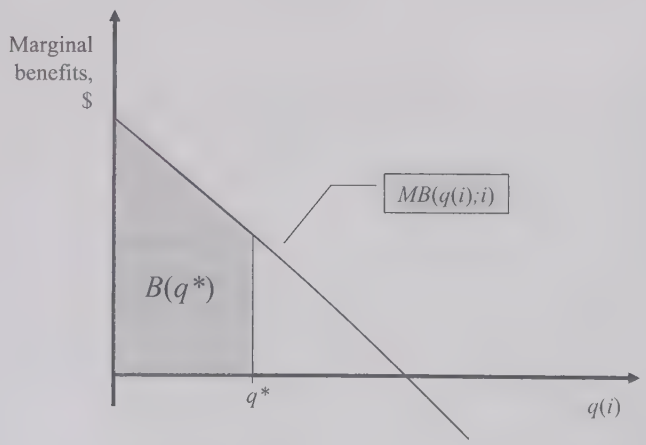
Since we are considering the allocation of more or less rights to the fishers it is helpful to consider the marginal benefit function, i.e. a function describing the additional benefits they get from additional units of rights. This function is formally defined as:

$$(2)\quad MB(q(i);i) \qquad \frac{dB(q(i);i)}{dq(i)} \qquad i=1,2,$$

where the notation MB is supposed to indicate marginal benefits. In accordance with basic economic premises (the law of diminishing marginal returns, see e.g. Varian, 1992), we assume that the marginal benefits of additional fishing rights are falling as the rights increase, at least ultimately. On this basis we can illustrate the marginal benefit function as in Figure 1.

As indicated in the figure the marginal benefits are initially high positive but as the quantity of rights increases, the marginal benefits decline and, as the figure is drawn, finally become negative. This last part may be unrealistic, but is of no consequence for the analysis that follows. As far as that is concerned, we may just as easily have a marginal benefit curve that is asymptotic to the horizontal axis.

FIGURE 1
Marginal benefits of fisher *i*



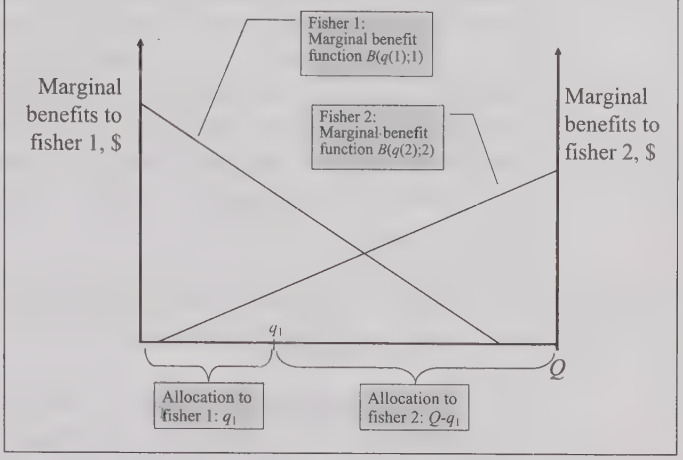
To understand the analysis that follows, it is important to realize that the total benefits to fisher i from any quantity of rights, q(i), he receives are given by the integral of the marginal benefit curve from zero to that quantity. For instance, in Figure 1, the total benefits fisher i receives from using rights q* are given by the area underneath the marginal benefit curve to q* as indicated in the diagram in Figure 1.

[227] Under a poor fisheries management regime, equilibrium profits in the fishery are zero and, consequently, rights to such a fishery are approximately worthless.

[228] As is well known utility can in general be expressed in monetary units (money metric utility function, see e.g. Varian 1992).

Now, consider the allocation of an aggregate fishing right, e.g. a TAC or some other right, to our two fishing firms. Let us refer to the total right to be allocated as Q. The essentials of the situation can be expressed as in Figure 2. In this figure, we measure the marginal benefits of rights allocation to fisher 1 on the left-hand vertical axis and the marginal benefits to firm 2 on the right-hand vertical axis. The total right to be allocated (i.e. Q) is measured along the horizontal axis between the two vertical axes. Any point on the horizontal axis represents a given allocation to the two fishers. Thus the point q1 represents the allocation of q1 units to fisher 1 and the remaining (Q-q1) units to fisher 2.

FIGURE 2
The basic allocation diagram


Fisher 1: Marginal benefit function $B(q(1);1)$
Fisher 2: Marginal benefit function $B(q(2);2)$
Marginal benefits to fisher 1, $
Marginal benefits to fisher 2, $
q_1
Q
Allocation to fisher 1: q_1
Allocation to fisher 2: Q-q_1

Finally, we assume that total social benefits from the fishing activity are equal to the sum of individual benefits. More formally:

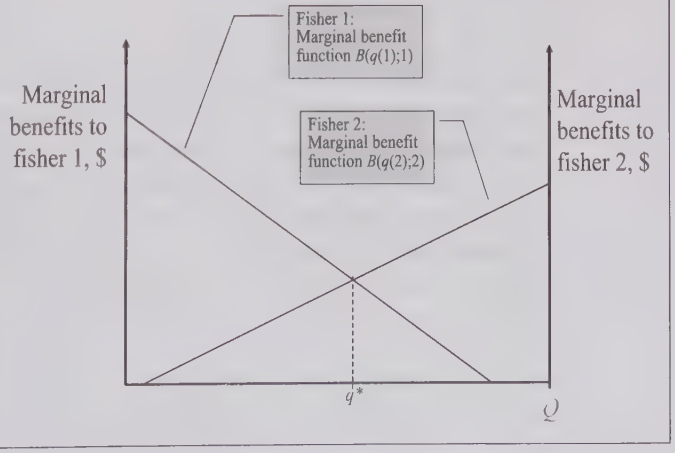
$$(3)\ W = B(q(1);1) + B(Q - q(1);2)$$

where W denotes the social benefits (or welfare) generated from a fishery allocating rights q(1) to fisher 1 and Q-q(1) to fisher 2. Note that by this adopting this assumption, we are explicitly ignoring the possible impacts the fishing activity might have on other agents and sectors in the economy.

To be able to assess the efficiency impacts of allocation of fishing rights, we obviously need to identify the most efficient, i.e. the socially optimal, division of the use of the fishing rights (as opposed to the mere allocation of these rights). A moment's thought will reveal that provided both fishers harvest, this point occurs where the two marginal benefits are equal, i.e. MB(q(1);1)=MB(Q-q(1);2). This point is illustrated in Figure 3.

Why this should be the case is easy to see. Let the division of the use of the fishing rights be at the socially optimal point, q* in Figure 3. Now imagine a little increase in the use by firm 1 and a corresponding reduction in the use by firm 2 — remember the overall right, Q, is constant. Then, a quick look glance at the two marginal benefit curves in Figure 1 reveals that the increased benefits to fisher 1 are not sufficient to compensate for the reduced benefits to fisher 2. Therefore, this change in use reduces the overall or social benefits. A corresponding argument holds for an increase in the use by fisher 2 (and a reduction in the use of fisher 1) from q*. Thus, q* must be the optimal division of the use of rights (i.e. resource use) by the two firms.

FIGURE 3
Optimal division of the use of fishing rights


Fisher 1: Marginal benefit function $B(q(1);1)$
Fisher 2: Marginal benefit function $B(q(2);2)$
Marginal benefits to fisher 1, $
Marginal benefits to fisher 2, $
q^*
Q

The preliminaries are now over and we are in a position to examine

the efficiency impact of different allocations of fishing rights. Allocation of rights corresponds to a point on the horizontal axis in Figure 3. For many technical and administrative reasons this allocation would almost certainly not be the optimal division of rights use. To move from this point of allocation to the most efficient usage point, q*, requires trading of the allocated rights. Therefore, obviously, the efficiency of the allocation depends on how smoothly these trades can occur. In this study we consider two types of trading barriers; (i) formal restrictions on trades[229] and (ii) transaction costs which basically cover all sorts of market imperfections such as the cost of finding trading partners and effecting trades, the payment of commissions, registration fees and so on.

On this basis, we consider three special cases as follows: (1) perfect tradability of rights and no transaction costs; (2) perfect tradability of rights and transaction costs; and (3) non-tradability of rights and no transaction costs.

2.1 Perfect tradability, zero transaction costs

This case is straight forward. Irrespective of the initial allocation, both parties will benefit from trading toward the optimal usage point, q*. The arguments are the same as for the optimality of q* itself. At any point outside q*, say slightly below q*, the marginal benefits of fisher 1 from an increase in his use of fishing rights is greater than the cost to fisher 2 of reducing his right. As a result both will benefit from trade in the direction of q* and since there are no obstacles to trade, this trade will occur. This shows that the optimal division of the use of rights, i.e. q*, is the only equilibrium in the market.[230] So, in the absence of any trade barriers, the point q* will be reached. We conclude that in this case allocation does not matter for efficiency. More formally, we have the basic result:

RESULT 1

If there is perfect tradability and no transaction costs, then allocation of rights has no effect on efficiency — the division of resource use will be optimal irrespective of the allocation.

2.2 Perfect tradability, positive transaction costs

Let us now consider the case of transaction costs. To simplify matters, let the transaction costs be constant per unit of trade. So they are like fixed commission fees, trading taxes or simply the cost of finding a suitable trading partner that increases proportionately with the amount of trade. Without any loss in generality (but considerable gain in concreteness) let us assume the buyer bears this cost. So, for someone who has to purchase all his use rights, his benefits are simply reduced by the amount of transaction costs. This, in effect, shifts his marginal benefit curve of resource use downward by the amount of the transaction.[231]

So for the sake of illustration, consider the case where fisher 1 is allocated a smallish amount q1, as in Figure 4, and buys additional fishing rights from fisher 2. Then, his marginal benefit curve is reduced by the amount of the transaction costs as illustrated in Figure 4. The trading equilibrium is now at q', not q*. Therefore, the division of resource use will be sub-optimal compared to optimal allocation of rights. Remember that if the allocation had been at q*, there would have been no trading and therefore no transaction costs incurred. The loss in benefits is measured by the shaded area in Figure 4.

[229] Which is basically the same as reducing the quality of the property right (Arnason 2000).
[230] For a formal proof see Appendix 2.
[231] For the formal derivation of this consult Appendix 3.

These arguments show that in the presence of transaction costs, the division of resource use is no longer independent of the allocation of use rights. The wrong allocation - and there is only one correct one - will lead to a loss in economic efficiency. This establishes our second basic result:

RESULT 2

If there are transaction costs, the allocation of rights has implications for efficiency - only an allocation identical to optimal division of resource use will be fully efficient.

Note that with any allocation of rights falling in the interval [q', q*] and a corresponding interval on the other side of q*, there will be no trades. The benefits from trade will simply be too little to the fishermen to justify the associated transaction costs. Refer to this interval around q* as the non-trading interval.

From the diagram in Figure 4, it is easy to see that the efficiency loss depends on the amount of transaction costs, t, as well as the slopes of the two marginal benefit curves. Moreover, as we have already seen, it depends on the allocation of rights itself. If the allocation of rights is correct, there will be no losses, If the allocation of rights is within the non-trading interval the efficiency loss will be less than the one indicated in Figure 4. If the allocation is outside the no-trading interval the loss equals the one indicated in Figure 4. As a function of allocation, the efficiency loss of sub-optimal allocation under this type of transaction costs will be similar to the curve drawn in Figure 5.

FIGURE 4
Transaction costs

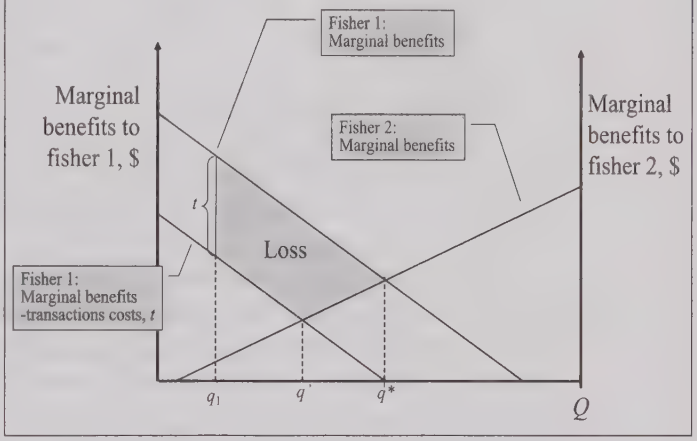
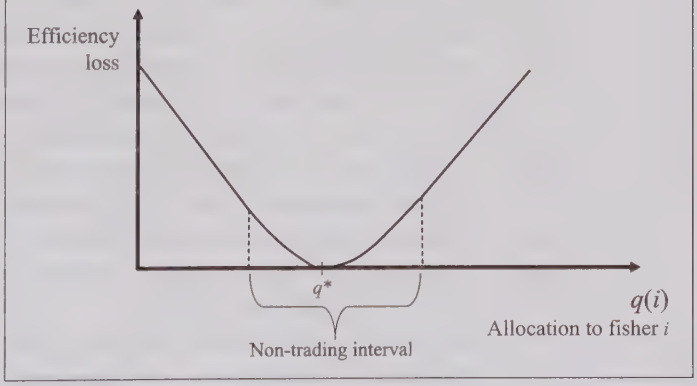


FIGURE 5
Transaction costs: Allocation and efficiency loss



2.3 No tradability, zero transaction costs

Resource use rights may not be legally tradable. This, for instance, is the case with non-tradable quotas, IQs. Obviously, non-tradability for legal reasons constitutes a substantial weakening of the property rights quality of the use right in question. Irrespective of its source, non-tradability may be represented as very high transaction costs, i.e. transaction costs so high that no trade can occur. So, basically, we can apply the analysis of the previous section with the modification that the non-trading interval now covers the whole allocation. So, in the case of non-tradability, the allocation of rights is also the division of resource use. Thus we have established our third basic result as follows:

RESULT 3

If there is no (or limited) tradability, then allocation of rights has implications for efficiency - only an allocation identical to optimal division of resource will be fully efficient.

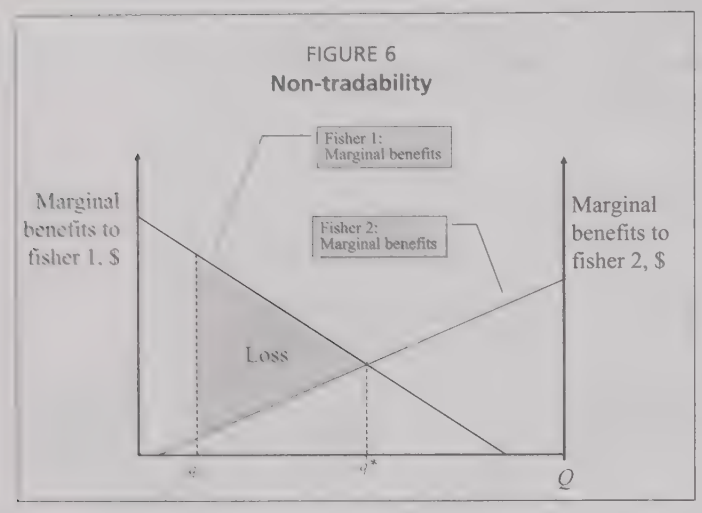


FIGURE 6
Non-tradability

The impact of non-tradability is illustrated in Figure 6. In this figure we have the same allocation as in the transactions costs case, namely at q1. Since trades cannot occur this is also the division of resource use and the loss, compared to full tradability and no transactions costs is as indicated in Figure 6.

Comparing Figures 4 and 6 immediately shows that provided the allocation is outside the non-trading interval, non-tradability can lead to much greater losses than in the case of mere transaction costs.

In terms of the diagram in Figure 5, this implies that the loss function is increasing at an increasing rate with the deviations from the correct allocation. In principle, the wrong allocation, i.e. one to someone who cannot use the resource profitably, can lead to loss of all benefits. In the case of non-tradability, therefore, the correct allocation is even more crucial than in the case of mere transaction costs of a reasonable magnitude.

3. ALLOCATION AND DISTRIBUTION

We have seen that the allocation of fisheries rights may or may not have an impact on efficiency of resource use. By contrast, the allocation of rights will generally be the major determinant of the distribution of the benefits associated with the right. As a general rule, provided the rent is transferable, the receivers of the allocation will receive a significant part of the benefits the right can generate irrespective of their own efficiency and how much use they will make of the right. To be more precise, the receiver of the right will normally receive at least the economic rents (Alchian, 1987; Arnason, 2006) associated with the right. He will, however, not normally receive the full benefits that the right generates. What he typically does not get his hands on in terms of benefits is the surplus, often referred to as intra-marginal rents, the more efficient buyer of the rights obtains.

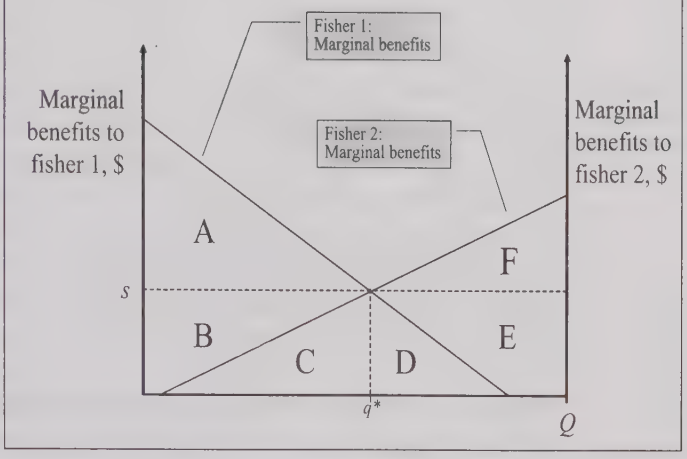
To analyse the general relationship between the allocation of fishing rights and the distribution of the benefits for the fishery is a very complicated task. Fortunately, it turns out that the essentials of the distributional issue can be illustrated with the help of a diagram similar to the ones employed in section 1. A more detailed analysis is given in Appendix 6.

Consider the case of two fishers as in Figure 3 above, where the optimal division of resource use is q*. Now, let all the rights be allocated to fisher 1. Then, if there are no barriers to trade, he will sell a part of this right, more precisely Q- q*, to fisher 2 at the approximately the market equilibrium price s (see Figure 7). At this price the two marginal benefits will be equal. More precisely $s = B_q(q^*;1) = B_q(Q - q^*;2)$ as illustrated in Figure 7.

Now, the total benefits generated by the fishery are represented by the area underneath the two marginal benefit curves. This area may be divided into six

segments, labelled A, B, C, D, E and F in Figure 7, whose sum equals total benefits. Note that a part of these total benefits, namely the segments B+C+D+E or more concisely the square s Q represents fisheries rents (Alchian, 1987, Arnason, 2006).

FIGURE 7
Distribution of benefits



Now, out of these total benefits, fisher 1, the one receiving all the rights, will receive benefits A+B+C from using the resource (fishing) and benefits D+E from selling part of his rights allocation to fisher 2. So, in addition to all the fisheries rents he receives the intra-marginal profits, A. Fisher 2, on the other hand receives benefits amounting to D+E+F from his resource use but has to pay fisher 1 the rent D+E for the privilege. As a result his net benefits amount only to his intra-marginal profits, namely F.

So, in the case illustrated in Figure 7, fisher 1 gets most of the benefits. However, it is important to note, he does not get all the benefits. Fisher 2, who has to buy all his rights gets a part of the total benefits of the resource use. This establishes the basic result:

RESULT 4
The recipients of use rights allocations do not generally get all the benefits of using these resources.

From the diagram in Figure 7, it may appear that the recipient of rights gets the bulk of the total benefits. This, however, is only a feature of how the diagram is drawn and is not a does not have to be the case at all. Imagine for instance the case where the recipient of the right, i.e. fisher 1, is very inefficient while the other fisher (or, more generally, group of fishers) is much more efficient. This case is illustrated in Figure 8. In this case, fisher 1 will not do any fishing, although he can do that profitably. He will get all his benefits from selling is quota allocation. Thus, he will receive benefits indicated by areas A and B in Figure 8. All of these benefits are rents. Fisher 2, on the other hand will get C which, as the diagram is drawn, is actually larger than the rents. Obviously, other configurations of the situation can make fisher's 1 share arbitrarily low.

So, this analysis shows that, contrary to what is often asserted in the political debate about rights to resources, that efficiency is actually rewarded. Irrespective of the allocation of resource rights, the most efficient entities (firms and individuals) according to the above analysis generally receive a significant par of the benefits of resource use. If they are really highly efficient compared to the rest they may even receive the bulk of the benefits. This analytical result seems to be supported by everyday observations. Oil companies for instance generally have not been allocated many oil rights for free. In fact, most of their production is under

FIGURE 8
Distribution of benefits

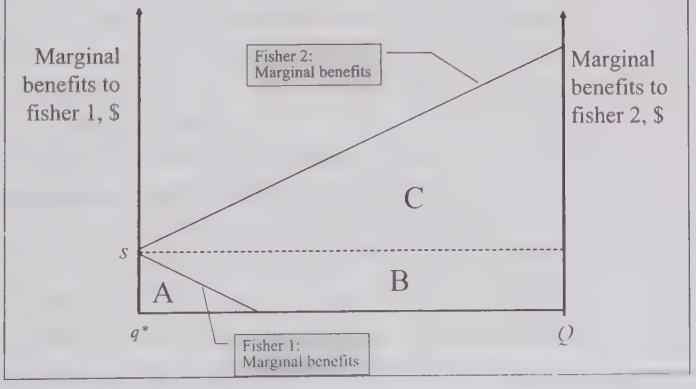
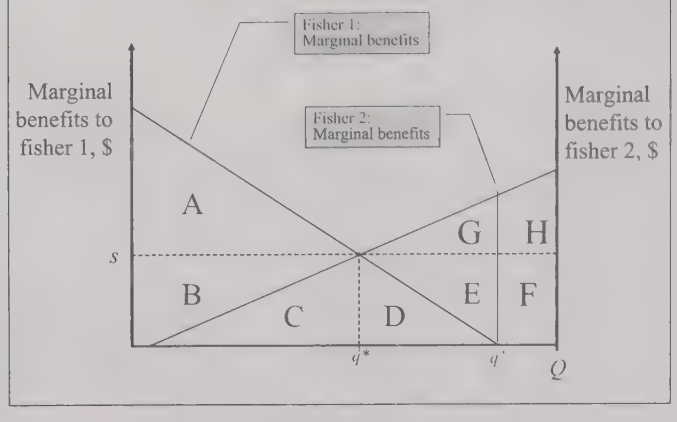


FIGURE 9
Restriction on trades: Distribution of benefits



licence with oil rich states which are both well informed and powerful. Many oil companies nevertheless make a lot of money. The most likely explanation is not that they are monopolistic and dishonest (although they may well be). The most likely explanation is that they make money primarily because they are more efficient in using oil reserves than the owners of the same reserves.

Sometimes, it is proposed to restrict transferability in order to achieve a fairer or at least more equitable distribution of the benefits. We can use the diagrammatic tool in Figure 7 to examine the validity of this claim. Consider again the situation depicted in Figure 7, with fisher 1 getting all the allocation and receiving the bulk of the total benefits of resource use. As we pointed out when discussing Figure 7, a good deal of these benefits are from selling use rights to fisher 2. Faced with this situation, let us assume that the authorities decide to restrict fisher 1's sales of use rights to Q-q'. This basically forces fisher 1 to fish at q' as illustrated in Figure 9.

This official restriction on trading will firstly, as we have already seen in section 2(3) on no tradability above, lead to a loss in total benefits amounting to G+E as illustrated in Figure 9. Secondly, it will obviously cause a disequilibrium situation in the use rights market - at least one of the parties, if not both, would like to trade more at the market price. However, if we are willing to assume for the sake of argument, that the price will remain the same, i.e. at s, it is easy to check the distribution of benefits between the partners before and after the imposition of the trading restriction. The result is summarized in Table 1.

TABLE 1
Trading restrictions or not: distribution of benefits

	Benefits		
	Fisher 1	Fisher 2	Total
No trading restrictions	A+B+C+D+E+F	G+H	A+B+C+D+E+F+G+H
Trading restrictions	A+B+C+D+F	H	A+B+C+D+F+H
Difference	E	G	G+E

Table 1 verifies our assertion that total benefits are reduced by the trading restriction. It also shows that fisher 1 is certainly hurt by the restriction. However, possibly unexpectedly so is fisher 2. In fact, depending on the shape of the two marginal benefit curves, he could well suffer even more from the restriction than fisher 1. Indeed, as should be clear from Table 1, it is by no means clear that fisher's 2 share of the new (and lower) total benefits is greater than before. We summarize these results as follows:

RESULT 4
Restrictions on trade will:
(i) Generally reduce overall benefits of resource use; and
(ii) Possibly lead to a more inequitable situation.

Taxes on the trade in rights, will generally lead to a sub-optimal use of the fishing rights. In this way they work very much like transaction costs. However, unlike transaction costs they are not economic losses, at least not right away. Thus, they could in principle be reallocated to those deemed disadvantaged by the configuration of rights

ownership. However, even so, it is quite possible that the reduction in efficiency and the allocation of that loss will more than outweigh the potential gain from reallocated tax revenues.

4. CONCLUSIONS

Good (high quality) property rights have been found to promote efficiency as well as sustainability in many fisheries around the world. This makes the creation of these types of fishing rights an appealing option for fisheries authorities.

The creation of fishing rights, however, implies the need to allocate these rights. This is a task with both technical and political ramifications. Technically, one allocation may be more efficient than another. Politically, allocation of rights (as well as duties) is always subject to controversy. This controversy tends to be the more heated the more valuable the rights are. It so happens that in commercial fisheries high quality rights are often quite valuable.

This paper has attempted to illuminate these questions. Primarily it has investigated the problem of efficient allocations. However, it has also examined the distributional impacts of particular allocations.

On the question of allocation and efficiency, the analysis has established the following basic results:

- If there is perfect tradability and no transactions costs, the allocation of rights has no effect on efficiency — the division of resource use will be optimal independently of the allocation.
- If there is either limited tradability or transaction costs, then the allocation of rights has implications for efficiency — only an allocation identical to the optimal division of resource will be efficient.

If efficiency is of concern, these results have certain fairly obvious policy implications:

1. It is generally not a good idea to restrict tradability of resource use rights.
2. Instead the authorities should consider taking steps to facilitate trades (by legislation, regulations, institutions etc.) in order to minimize transaction costs.
3. Since, there are always certain transaction costs, even when they are low, the authorities should attempt to allocate use rights to the most likely users.

The most likely users of fisheries rights are indeed existing fishermen. So, policy implication (3), provides support for the usual government procedure of allocating fisheries rights to those already established and with a track record in the fishery.

On the question of allocation of rights and the distribution of the benefits obtainable from using these rights, the analysis produced the following basic result:

- The recipients of use rights allocations do not generally get all the benefits of using these resources.

This result directly contradicts the conventional wisdom, much branded about in public debates about fisheries quota rights, that the initial receivers of quotas receive all the benefits of the resource. It may be true, as a general empirical pattern in fisheries, that most of the benefits from use of fisheries property rights will be reflected in quota values. However, the analysis shows that this does not have to be the case. Therefore, to assert otherwise can only be done on the basis of an empirical study of the fisheries situation in question.

While this paper may have managed to clarify the issues and, hopefully, correct so me of the most glaring misconceptions concerning the allocation of fisheries rights, the reader should be warned that it does not represent a deep or comprehensive analysis —far from it. The allocation of rights and the resulting efficiency and distribution of benefits is a complicated issue. This paper has done little more than scratch the surface of that issue. Among the things, of apparent importance but completely ignored in the paper are:

1. **What are the benefits?** The maximum benefits associated with rights depend among other things on the quality of these rights. Certain fishing rights, e.g. access licences, the right to invest etc., are of low quality and therefore not worth much. Other rights such as TURFs and ITQs are of high quality and can be very valuable. This distinction is completely ignored in the paper. One might say, although this is not accurate, that the paper proceeds as if the rights in question are always of high quality. The main thing is that with low quality property right the question of allocation and efficiency and allocation and distribution becomes largely irrelevant as there is very little efficiency to lose and very little benefits to distribute.
2. **Mistakes by players.** Fishers, like everyone else make mistakes. They may trade or fish erroneously. These mistakes will have implications for both efficiency and distribution. Taking the mistakes to be stochastic, the question rises what are the implication for policy. This is not at all dealt with in the paper.
3. **Fairness.** The question of fairness is also completely ignored in this paper. This is partly because economics, as, I believe, every science, has very little to say about justice and fairness. However, although it is probably not a topic for scientific inquire, a great deal of sensible things can be said about fairness. To attempt that, however, would be beyond the scope of this paper. This is the main reason why this topic was dropped from the paper.

Finally, it is interesting to note that historically speaking property rights are often takings. Over time, many of these takings become established as a part of the social order, almost as if they belong to the nature of things. Takings, at least when it is creating private property rights from previously common or totally un-owned natural resources, have many good economic properties. For one thing they constitute a solution or at least an alleviation of the common property problem as is very well known. It is less recognized that the social custom of recognizing property rights on the basis of takings generates a powerful incentive to entrepreneurs to invent and establish new types of property rights. If takings entail socially accepted property rights they will gain personally by these kinds of effort. And by their personal gain and the increased economic efficiency generated by a more extensive property rights system, most of the other members of society will gain as well.

These observations on the benefits of takings as a means of creating property rights seem to undermine the validity of public allocations of rights to individuals. Perhaps that is the wrong way to look at the problem. Perhaps, the state, the entity most people seem to have in mind as an allocator of rights, would be of more service if it just concentrated on establishing and supporting the property rights quality of takings. If so, the problem of allocation, with which this paper is concerned, would simply cease to be of relevance.

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Appendices

A1. Optimal division of resource use

Let Q represent total rights and the rights usage of fisher 1 be q. It follows that the usage of fisher 2 is q(2) = Q-q. Social benefits of this usage is

$$W = B_q(q;1) + B(Q - q;2)$$

In what follows, explicit reference to the two fishers will generally be dropped from the benefit functions unless confusion may arise.

Maximizing W with respect to q yields:

(Eq. A1) $B_{q(1)}(q(1)) = B_{q(2)}(q(2))$

In other words, maximum total benefits occur at the point where the two marginal benefits of resource use are equal.

A2. No trade barriers imply optimal division of resource use

Let $\bar{q}$ be the allocation to fisher 1. It follows that the allocation to fisher 2 is $Q - \bar{q}$
Let z be the purchase of rights by fisher 1 from fisher 2. Obviously, if the fisher 1 sells rights to fisher 2, then $z < 0$. With trades the rights usage of fisher 1 will be $\bar{q} + z$ and that of fisher 2 . $Q - \bar{q} - z$ With costless trading, private benefits for the fisher 1 will be:

$$B(\bar{q} + z) - s \cdot z \ ,$$

where s is the market price of quota. For him profit maximization (assuming no corner solutions) implies:

(Eq. A2) $B_{q(1)}(q(1)) \equiv B_{q(1)}(\bar{q}\ (1) + z(1)) = s$

For fisher 2 the private benefits will similarly be:

$$B(\bar{q} + z) - s \cdot z$$

and his profit maximization (assuming no corner solutions) implies:

(Eq. A3) $B_{q(2)}(q(2)) \equiv B_{q(2)}(Q - \bar{q}\ (2) + z) = s$

It follows immediately from (A.2) and A.3) that market equilibrium requires:

$$B_{q(1)}(q(1)) = B_{q(2)}(q(2)) \ ,$$

Which is identical to the social optimum expressed in (Eq. A1).

A3. Transactions cost imply sub-optimal division of resource use

Let there be transaction costs defined by T=t·z. Then one or both of the traders will have to bear this cost if trades occur. For convenience, and with no impact on the results, let the buyer bear this cost. His private benefits under trading then become:

$B(\bar{q} + z) - s \cdot z - t \cdot z$.

His profit maximizing condition under trade becomes (assuming no corner solutions):

(Eq. A4) $B_{q(1)}(q(1)) = s + t$.

The seller's profit maximizing conditions are unchanged and given by condition (Eq. A3) above.

Combining (Eq. A4) and (Eq. A3) yields the market equilibrium condition:

(Eq. A5) $B_{q(1)}(q(1)) - t = B_{q(2)}(q(2))$.

This expression shows that in market equilibrium the marginal benefits of resource use to the rights buyer will in general be higher than that to the resource seller, the difference being the unit transaction costs, t. So, comparing (Eq. A5) to the social optimality condition (Eq. A1), above shows that under transaction costs, division of resource use will generally not be optimal. More to the point it will not be optimal unless the allocation of rights will be perfect, i.e. precisely the same as the optimal division of resource use (i.e. trade is not necessary.

The inefficiency or loss in benefits associated with the less than perfect allocation of rights is difficult to work out in general. It depends as already indicated on (i) the initial allocation, (ii) the size of transaction costs and (iii) the shape of the two marginal benefit curves. Assuming that (Eq. A5) holds, i.e. no corner solutions, we may write this loss for any allocation q1<q' as

(Eq. A6) $L = \int_{q_1}^{q^*} B_q(\bar{q}\ (1);1) - B_q(Q - \bar{q}(1);2))dq + \int_{q_1}^{q'} (B_q(\bar{q}\ (1);1) - t - B_q(Q - \bar{q}(1);2))dq$

where q' refers to the actual and q* to the optimal division of resource use.

Qualitatively similar results can be obtained with other types of transaction costs such as transaction costs depending on the volume of the transaction and transaction costs that are fixed per transaction, i.e. independent of the volume of transaction.

A4. Non-tradability implies sub-optimal division of resource use

Non-tradability may be seen as an extreme case of transaction costs (infinite transaction costs) so that no trade can occur. In that case, the allocation of rights is also the division of resource use.

The two marginal benefits will be $B_{q(1)}(\bar{q}\ (1))$ and $B_{q(2)}(Q - q(1))$.

And it is obvious that only perfect allocation will result in socially optimal division of resource use (Eq. A1).

Assuming both fishers receive allocation of rights, the loss will be given by:

(Eq. A7) $L = \int_{\bar{q}}^{q^*} B_q(\bar{q}\ (1);1) - B(Q - \bar{q}(1);2)dq$

where q* refers to the optimal division of resource use and we have assumed that the allocation to fisher 1 is less than his socially optimal use of the resource.

A5. Size of loss

According to (A.6) and (A.7) the loss due to transaction costs (including non-tradability lies in the interval [0,], where is the maximum total benefits from the resources. The lower bound, 0, is reached when the allocation of rights is perfect. The upper

bound, , is reached when all allocation is to a totally inefficient fisher,) B_q)$B_{q(2)}$ and transaction costs exceed maximum marginal benefits of the other fishers.

A6. Allocation of rights and distribution of income

Assume that one of the fishers, e.g. fisher 1, receives the allocation $\bar{q}$. Assume he finds it beneficial sell a part or all of this allocation, z, say. The resulting resource use is: $\tilde{q} = \bar{q} - z$. Fisher 1's benefits are now:

$$B(1) = \int_0^{\tilde{q}} B_q(q)dq + z \cdot s$$

where, as before, Bq(q) represents is marginal benefits from the harvest level q and s is the price at which he can sell his quota. So, the first term in this expression represents his benefits from fishing and the last term his benefits from selling a part of his right.

The benefits of the buyer, i.e. fisher 2, from buying and using the purchased quantity z is:

$$B(2) = \int_0^{z} B_q(q;2)dq - s \cdot z$$

But B(2) 0. Otherwise fisher 2 would not undertake the trade. Moreover, if B(q(2);2) is concave, which is the normal case, the marginal benefit function would be falling in the q and B(2) would be strictly positive (note that by market principles s $B_q(z)$).

This proves, that provided there exist more efficient (for some part of the allocation) fishers than the one receiving the allocation, i.e. the receiver elects to trade some of his allocation, others will share in the total benefits of the right.

How much of the total benefits others will share depends on the parameters of the situation. It increases with the efficiency of the buyer and it falls with the efficiency of the one who receives the allocation. In principle, the buyer or the allocation, i.e. the one who ultimately uses the right may receive virtually all of the benefits.

Allocation of fisheries resources: a small-scale fisheries perspective[232]

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1. INTRODUCTION

Good afternoon everybody. First of all, I would like to thank the organizers of this conference for giving us this opportunity to share what we see as a small-scale fisheries perspective on resource allocation issues.

Much of what I'm going to say is based on work with fish worker organizations, primarily in countries of the south in Asia, Africa, and Latin America. I've worked with them for the past 20 years on various issues.

This presentation will focus on the developing countries, and it is important to keep in mind the fact that as much as 95% of the world's fisher population is in Asia, Africa, and Latin America, with 87% only in Asia. It's also important to keep in mind that Asia, Africa, and Latin America contribute 77% of the world's fish production, and 75% of the marine fish production, so we are really talking here about – in a sense – the tropical majority.

1.1 Importance of small-scale fisheries

I'd also like to briefly go over the importance of small-scale fisheries. I think we all know that they are an important source of employment, food security in diversified rural economies in the developing world income. An estimated 90% of the 38 million people recorded as fishers and fish farmers are small-scale. An additional more than 100 million people are employed in other fisheries-associated occupations – processing, trade, etc. It is important to keep in mind, is that these figures are likely to be underestimates. Millions of people fish seasonally, part-time, in coastal and inland waters, and are not recorded as fishers.

It's also important to keep in mind that, according to estimates, about 20% of the total number of fishers, or about 5.8 million fishers, are considered to earn less than 1 United States dollar per day. So we are talking about a sector which is quite economically vulnerable.

As important – small-scale fisheries in the developing world are often the main drivers in the rural economy. Those of us who are familiar with the recent tsunami saw that. With the collapse of the fisheries in the tsunami-affected countries, it affected not only the fisherman, but also a whole of host others who were dependent on the fisheries sector in remote areas – people supplying inputs, people buying, processing fish, people supplying inputs to fishing communities – painting their houses, selling

[232] Presentation can be found at http://www.fish.wa.gov.au/docs/events/ShareFish/papers/pdf/presentations/Present-ChandrikaSharma.pdf

things to them – they're really the main drivers in rural economy. So I think the importance of the sector should not be undermined. And, I think it's important that it has not been valued as correctly, or as appropriately, as it should have been – these sorts of backward and forward linkages are still not taken into account when estimates are made about the importance of the sector.

Small-scale fisheries account for nearly 50% of the global fisheries production, and most – in fact, all – almost all of what they catch goes to direct human consumption. And I think we can relate this to the earlier figure that there are 90% of fishers who are small-scale, but they're catching about 50% of the fish – something on sharing that.

Small-scale fisheries increasingly contribute to export markets and earnings and to national economies. I think this is a growing trend now. As important – from an environmental point of view – small-scale fishers harvest resources in *relatively* – I stress, relatively – more sustainable ways. Their ecological footprint is smaller, and this is increasingly important today as concerns about sustainability of our resources, the cost of inputs, the cost of fuel, and so on, rise.

1.2 Defining small-scale fisheries

A very basic issue, on which a lot of time has been spent, is the question of: What are small-scale fisheries? I think it's widely agreed that it is widely divergent from country to country, and particularly between the industrialized world and the developing world. There is a recent WTO note which tries to compile available definitions and that clearly brings this out. The sector is also referred to differently – artisanal, subsistence, small-scale, so on.

It's very important to note that the sector is not what it was two or three decades back. Technological changes have taken place. There is increasing differentiation within the sector with motorization and greater efficiency within the small-scale sector which makes defining it more challenging.

Just to give some basics: the Catamaran, from Tamil Nadu, India is just three logs of wood tied together; the beach seine from Mozambique is just that; you also have the fishing boat from Kerala. This is a growing sort of technology and investment is much more than in the trawling sector in India. The boat employs 30 people in one go and uses the mini purse seine. So you can see that within the sector there is a whole range of differentiation which one can see today.

And this is the pump-boat from the Philippines which actually carries, on its side, small boats which are handliners. These go out of the Philippines EEZ; it actually goes to other countries. It is a very artisanal technology, but it's going outside, as I said, the EEZ. This is also part of, in a sense, the small-scale sector.

You have the multi-day boats of Sri Lanka, which are recently evolved sort of vessel design. You find them not only in Sri Lanka, India; you find them in Madagascar, Somalia, and the Seychelles. These are small 15–20 metre boats and seen as part of the small-scale sector. So I'm saying we have a range now, within the sector, and it's important to keep that in mind.

I think the description of the FAO Working Group on Small-scale Fisheries does capture a bit of what this sector is – dynamic; evolving; labour intensive; supplies fish to local and domestic markets but also is export-oriented; widely different organizational levels, from self-employed single operators through formal sector businesses. It is important to keep this range in mind.

2. RECOGNITION OF SMALL-SCALE FISHERIES

2.1 Recognition of small-scale fisheries in international legal instruments

Very briefly, I'm going to skip over some of the kinds of recognition that small-scale fisheries has in the international legal framework. UNCLOS (Article 61) talks about the economic needs of coastal fishing communities, and the requirements of developing

States. The United Nations Fish Stocks Agreement (UNFSA) – important to note – talks about "the need to avoid adverse impacts on, and ensure access to fisheries by subsistence, small-scale and artisanal fishers and women fish workers" (Article 24.2(b)). This is important to keep in mind when we talk about the tuna boats of Sri Lanka, Philippines and, increasingly, in many other countries, targeting fish outside of EEZs because here we have small-scale fisheries, and there is a need by the UNFSA to ensure access to fisheries by these fishers.

Recognition of small-scale fisheries is also in Agenda 21 (Section 17.74b), and the Code of Conduct for Responsible Fisheries (CCRF) talks about giving "preferential access, where appropriate, to traditional fishing grounds and resources" (Article 6.18) – an important allocation suggestion there. Also important to note that the Committee on Fisheries of FAO has recently mandated the development of technical guidelines on small-scale fisheries under the Code of Conduct - and that has been published. It also reflects a growing recognition of the sector among states and the need to ensure protection of the sector to enable it to contribute to its full potential.

2.2 Recognition of small-scale fisheries in national legal frameworks

Many national legal frameworks also recognize access rights of small-scale fish workers:

- The Venezuela Constitution of 2000 talks about protecting the fishing banks of the communities of non-industrialized fisherman (Article 305);
- the Philippine Constitution of 1997 talks about protecting the rights of subsistence fisherman to marine and fishing resources, both inland and offshore (Article XIII, Section 7);
- the Thai Constitution recognizes the role of communities and organizations in management and conservation of resources;
- Marshall Islands Marine Resources Act, 1997 - and in fact, many other Pacific Island states - again, recognize the rights of access of small-scale fishing communities to resources;
- The recent Indonesian law (Law of the Republic of Indonesia No. 31 of 2004 Concerning Fisheries) exempts small-scale fishers and fish farmers from payment of fees and levies (Article 50) and from licensing requirements (Article 63.3), and allows them to fish in the entire fisheries zone of Indonesia.

Similarly, we have Ghana (Fisheries Act 2002), Zanzibar (Tanzania Fisheries Act 1988, Article 8 on *Protection of traditional fisheries*), Fiji (Fisheries Act) – the basic point being that many national legislations do recognize the need for preferential access rights for small-scale fisheries and to protect their rights to resources allocation.

The SADC Protocol on Fisheries (Article 12 on *Artisanal, Subsistence Fisheries and Small-scale Commercial Fisheries*), which is a regional document, also has very strong language which talks of the protection of artisanal and subsistence fishing rights, tenures and fishing grounds.

3. SHARING THE FISH: ISSUES OF CONCERN

3.1 Problems and conflicts

One could say the importance of the sector and of protecting its resources, of allocating its resources to it fairly is very recognized in international and several national legal instruments. Most of the developing countries have taken specific measures to protect access of small-scale to resources, the most common being the declaration of artisanal fishing zones, which is quite common in Africa, Asia, and Latin America.

However, I think when we look at the situation on the ground, we find that there is a continuing problem with accessing resources, despite this recognition. I think the most common problem which small-scale fishers face in accessing resources securely – thereby their livelihoods – is this whole conflict with the industrial sector over resources.

It's very common to find trawlers and large-scale vessels fishing in inshore areas, destroying nets, gears, crafts of the small-scale fishers, sometimes even lives. So this is a common issue – this is a sort of violation of existing regulations by the industrial sector, it's quite common. We have the joint venture of fisheries access agreements – very, very common in many countries – which directly also impinge on the rights of local fishers. The most recent conflict is Mauritania small-scale fishers saying they can clearly harvest their own lobster resources, but the EU is also there with a fisheries access agreement.

Continuing reports of conflicts between migrant and local fisherman – again, the rights of the migrant fisherman are often not well recognized or taken into account in national legal frameworks, and this also leads to conflict between the local and the migrant boats. The migrants are also traditional fishers.

3.2 Denial of access to resources

In Chile and South Africa, the introduction of ITQs, seen as a measure that denies artisanal fisheries/indigenous people, legitimate access to resources, has been met with protest, and even litigation. I think our colleagues from South Africa will be sharing some of their experiences there, and the court case that is now on in South Africa against the ITQ which is being introduced there.

I'd like to stress the statement from a workshop ICSF recently organized in Latin America which had participation of all fish worker organizations from the continent, which clearly said,

> *"We reject the use of ITQs as a management tool for artisanal fisheries, and express our concern that the use of ITQs can jeopardize the legitimate rights of artisanal fish workers, coastal communities, and indigenous people to secure and just fishery-based livelihoods."* (Santa Clara Workshop, Argentina, March 2005)

It's also important to point out here that, according to a calculation of a colleague, about less than 1% of the world's fishers are under ITQs. I think you're talking here of a very different context.

Other areas of concern for small-scale fish workers include marine protected areas. Increasingly, there is a focus on this, them being set up in non-participatory ways, exclusionary ways, denying small-scale fish workers access to resources. Here again, I'd like to emphasize that the implications for the small-scale sector of marine protected areas is quite different. People who lack the technology or the wherewithal to fish further are impacted much more by declarations of marine protected areas then, say, the larger-scale sector who can move away from the zones and fish further.

I was struck yesterday that in Australia there is a process where they have tried to estimate the socioeconomic impacts of MPAs and even have a structural adjustment package, because actually you can calculate the loss to a sector and compensate. In most of our fisheries, there is, at the first place, no recognition of the small-scale sector, or any data about how much they earn – so the issue of compensation is far more complicated. The power the industry has here is nothing compared to what small-scale fishers in remote rural areas have. So I think these are important aspects to keep in mind.

4. SHARING THE FISH: EMERGING ISSUES

4.1 Emerging issues within the sector

Small-scale fishers in several countries have also been affected by certain forms of coastal aquaculture. Often their access to fishing grounds have been disrupted, or the fact that the environmental impacts of aquaculture – catching of juveniles, say, for example, in shrimp – affects resource productivity, and clearly, access to the resource.

What are the sort of emerging issues? I think that's sort of important. As I mentioned earlier, growing differentiation within the sector. Adaptation of gear earlier used by the

industrial sector – mini-trawls, mini-purse seines, now within the small-scale sector – and therefore much greater conflict within the small-scale sector.

The small-scale sector, as I earlier mentioned, is now able to move much further, further offshore into international waters, into the EEZs of other countries, targeting highly migratory stocks such as tuna.

4.2 Emerging cross-sectoral issues

Emerging cross-sectoral issues are as important vis-à-vis allocation. Greater competition from other sectors: tourism, industry, conservation interests, oil exploration. Small-scale fishers increasingly are facing problems of displacement from fishing grounds/ habitations.

Another great issue, a very important problem, is this whole issue of pollution, which is growing, It affects resource productivity and clearly, access to the resources.

5. SHARING THE FISH EQUITABLY

5.1 Important considerations for allocation

So when you look at, what are therefore, allocation issues in the small-scale sector and what could be done, or needs to be done, I think first let's keep in mind some important considerations which we need to keep in mind apart from what was mentioned earlier.

The numbers of people involved in small-scale fisheries, and we're talking about millions of people here who depend on small-scale fisheries and not only those who fish, but those who depend on the fishing operations, those in post-harvest operations – very often women in developing countries. One needs to keep that in mind before looking at allocation issues in a developing country context.

Also, in view of the commitment which all of our governments have made - the MDG goals - halving between 1990 and 2015 the proportion of population below $1 per day.

Other important considerations are: the contribution of the sub-sector to national and local economies and to food security; the relatively sustainable harvesting of resources by the sector and, importantly, greater fuel efficiency, very often self-powered operations in many parts of the world are non-motored; recent technological changes also need to be kept in mind.

5.2 A small-scale fisheries perspective

So what we feel – from a small-scale fisheries perspective – given all these considerations, what seems to be important is to promote the small-scale model of fisheries development, progressively redistribute fishing space and resources to the small-scale fisheries – owner-operators and workers in the fishery – by phasing out large-scale, non-selective fishing units.

And how? By promoting "scale subsidiarity". Consider larger fishing units only after exhausting the possibility of employing smaller fishing units in the same fishery in the entire range of distribution of relevant fish stocks, with due consideration for the safety of such fishing operations as well as the safety and working conditions of fishers.

One can confidently say that in many countries the small-scale fisheries can, given today's context, harvest resources within the EEZ. And, I think the important aspect here is to ensure that the lowest scale of operations, non-motorized fishing vessels, should be confined to the inshore, they should have secure access rights while the ones with greater technology should be pushed further offshore.

Put in place management systems and approaches that recognize the rights of small-scale fishing communities to resources and to manage them, and to be part of decision-making processes. I think that's equally important – yesterday there's the

whole community based management, co-management, I think these are all important, need to be community-driven processes.

Rights to resources have to be linked to responsibility for their sustainable management, and there is a need to invest in capacity building of fishing communities and their organizations.

Some concrete measures probably, which, of course have to be based on better data, and I think all developing countries do need better data on which to base management decisions on. But I think one measure which has been effective - and which can be much more effective - is to continue with the zoning of artisanal fishing zones, to increase areas under artisanal fishing zones, effectively implement them, and prioritize in these zones the interests of the non-motorized artisanal sector using selective gear.

Consider allocating rights to harvest commercially important species such as shrimp and lobster in territorial waters exclusively to small-scale fishers using selective gear. I think this can be clear in many other countries, we don't need trawlers. And of course, there was a lot of discussion about the destructive impact of bottom trawling in high seas – you can imagine the destructive impact of bottom trawling in fertile inshore waters where a lot of the spawning and breeding takes place. We have technology which can harvest the same resources in more selective ways, by the artisanal sector in more equitable ways, so there is clearly a strong case for allocating resource rights to harvest species such as this, exclusively to the small-scale sector, and perhaps, taking part of the revenue from this to plough back into management, better management, or to improve the conditions in the sector.

Equally important to implement other effort control measures, particularly bans on destructive gear, such as bottom trawls or many purse seines, where proved destructive, whether small-scale or industrial. I think here we are recognizing that it's not blind defence of the small-scale sector. One needs to be clear that there are selective and non-selective technologies within the small-scale, and what is non-selective has to be controlled.

Ensure that the interest of small-scale fishers targeting highly migratory stocks are represented in RFMOs set up under the UNFSA. I think this is an emerging issue – we talked about representation of NGOs and so on and RFMOs – but so far, small-scale fishers targeting highly migratory stocks are not enough recognized though they do catch a significant percentage, in the Indian Ocean for example, of tuna resources. Their interests have to be better represented in RFMOs and their access to these resources protected.

Migrant fishers: Again as I mentioned, there is not enough recognition within legal frameworks of migrant fishers, particularly when they're from across the border. One should consider things like bilateral agreements, which allow small-scale fishers to fish in neighbouring country waters, legally regulated without conflict.

Put in place effective enforcement systems: This has been discussed – lack of enforcement creates de facto open access condition, a race for fish won by those with greater access to capital and technology, and in this case, clearly, the advantage is with the large-scale in developing countries.

Discourage measures such as the ITQ - inappropriate for the typically multispecies, labour surplus fisheries of the developing world, that also have the potential of leading to inequity and greater conflict of interests within communities. And here I think this whole issue is that to even consider quota based allocation, one needs sound information, and most developing countries, where stocks are typically many and small, don't have adequate information. So, to even consider systems like this is completely not appropriate in that context, by and large.

MPAs: Consider them only where they're proposed through participatory processes, and after ensuring that access to resources and livelihoods of the small-scale sector using

selective gear are not compromised. And this is also in keeping with the Convention on Biological Diversity, and many of the decisions within that. And I think we do have many examples of community conserved areas, so there are many precedents where communities have taken the decision to conserve, and I think the effort has to be to support such initiatives.

Ensure that fisheries access agreements, joint ventures and other similar arrangements do not affect the fishing operations of the small-scale sector, including their access to resources.

Ensure that coastal aquaculture development does not affect the access of small-scale fishers to resources, and is sustainable from a social, economic and environmental perspective.

And, finally, ensure that the livelihoods of those dependent on small-scale fisheries are not compromised by other users of coastal resources – tourism, industry, or development, and so on. There is need to recognize that the sector is important from a livelihood perspective. It has a right to coastal space.

There is a need to take steps to control pollution of coastal areas, and I think this whole ecosystem approach to management makes a lot of sense in this context.

Ensure access to coastal land for housing and other fisheries-related operations, recognizing that access to resources at sea has meaning only when linked to access to coastal lands. If you displace fishing communities from coastal lands and shift them inwards, you are effectively denying them access to resources, because it's impossible to fish when you're far inland.

6. SHARING THE FISH EQUITABLY: CONCLUSION

In conclusion: small-scale fisheries make better sense from a social, cultural, economic and environmental perspective.

There is a need to promote the small-scale model based on scale subsidiarity. An ecosystem approach to managing fisheries is called for, given particularly the growing problems due to pollution. The livelihood interests of the small-scale sector need to be protected as competition over coastal resources from other sectors increases.

Thank you.

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Sharing the Fish '06

Allocation issues in fisheries management

27 February–2 March 2006
Fremantle, Western Australia

These proceedings contain the main papers and presentations from "*Sharing the Fish '06: Allocation issues in fisheries management*" conference that was held in Fremantle, Western Australia, 27 February to 2 March 2006. They include the substantial work of the keynote and invited speakers covering the three themes of the conference which addressed the critical fisheries management topics of:
(i) allocations across jurisdictions (including governmental, regional and multilateral, and national allocation issues);
(ii) allocations within sectors (including extractive and non-extractive allocations issues; management issues; and, commercial, artisanal and tourism allocations issues); and
(iii) allocations between sectors (including customary/indigenous, recreational, commercial, and artisanal/subsistence allocation issues). The enclosed CD-ROM contains the papers from the concurrent sessions which delved further into each of these allocation topics as shown in the Conference Programme section and mentioned in the Summary Report and Conclusions section.

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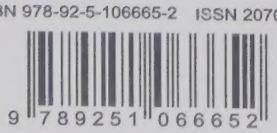

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